

278
34. 1921

REGISTER
OF
LEHIGH UNIVERSITY



1920-1921

BETHLEHEM
PENNSYLVANIA

CALENDAR

1920

1920—1921

Sept. 17, 18, 20, 21, (Friday, Saturday, Monday, Tuesday)	Examinations for admission.
Sept. 22, 3.30 P.M., (Wednesday)	First term begins.
Oct. 2, (Saturday)	Founder's Day.
Nov. 25, (Thursday)	Thanksgiving holiday.
Dec. 18, 12 M., (Saturday)	Christmas holidays begin.

1921

Jan. 3, 7.45 A.M., (Monday)	Christmas holidays end.
Jan. 28, 8.00 A.M., (Friday)	Examinations begin.
Feb. 4, 5.00 P.M., (Friday)	Examinations end.
Feb. 7, 7.45 A.M., (Monday)	Second term begins.
Feb. 22, (Tuesday, Washington's Birthday)	Junior Oratorical Contest.
April 23, 12.00 M., (Saturday)	Spring vacation begins.
May 2, 7.45 A.M., (Monday)	Spring vacation ends.
May 30, 8.00 A.M., (Monday)	Senior examinations begin.
June 1, 8.00 A.M., (Wednesday)	Other examinations begin.
June 8, 5.00 P.M., (Wednesday)	Examinations end.
June 11, (Saturday)	Alumni Day.
June 12, (Sunday)	Baccalaureate Sunday.
June 13, (Monday)	Class Day.
June 14, (Tuesday)	University Day.
June 15, (Wednesday)	Summer term begins.
June 15, 16, 17, 18, (Wednesday, Thurs- day, Friday, Saturday)	Examinations for admission.

1921

1921—1922

Sept. 16, 17, 19, 20, (Friday, Saturday, Monday, Tuesday)	Examinations for admission.
Sept. 21, 3.30 P.M., (Wednesday)	First term begins.
Oct. 1, (Saturday)	Founder's Day.
Nov. 24, (Thursday)	Thanksgiving holiday.
Dec. 17, 12.00 M., (Saturday)	Christmas holidays begin.

1922

Jan. 2, 7.45 A.M. (Monday)	Christmas holidays end.
Jan. 27, 8.00 A.M., (Friday)	Examinations begin.
Feb. 3, 5.00 P.M., (Friday)	Examinations end.
Feb. 6, 7.45 A.M., (Monday)	Second term begins.
Feb. 22, (Wednesday, Washington's Birthday)	Junior Oratorical Contest.
April 22, 12.00 M., (Saturday)	Spring vacation begins.
May 1, 7.45 A.M., (Monday)	Spring vacation ends.
May 29, 8.00 A.M., (Monday)	Senior examinations begin.
May 31, 8.00 A.M., (Wednesday)	Other examinations begin.
June 7, 5.00 P.M., (Wednesday)	Examinations end.
June 10, (Saturday)	Alumni Day.
June 11, (Sunday)	Baccalaureate Sunday.
June 12, (Monday)	Class Day.
June 13, (Tuesday)	University Day.
June 14, (Wednesday)	Summer term begins.
June 14, 15, 16, 17, (Wednesday, Thurs- day, Friday, Saturday)	Examinations for admission.

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* Resigned February 1, 1921.

LEHIGH UNIVERSITY

Lehigh University was chartered by the Legislature of Pennsylvania by act dated February 9, 1866. In 1865 the Hon. Asa Packer, of Mauch Chunk, inaugurated a movement to provide an institution that would afford training and education in the learned professions as then recognized, and in technical branches, the importance of which was then just becoming apparent in the development of the industrial and transportation interests of the country. He made an initial donation of \$500,000 and of a large tract of land for this purpose, to which he added largely during his lifetime and by his will.

Since its foundation the equipment and resources of the University have steadily increased due to the continued interest of the University's trustees, alumni and friends. The present endowment totals three million dollars. The first important addition to the University's original plant was the Sayre Observatory, donated in 1869 by Robert H. Sayre, of Bethlehem. Later donations include Packer Memorial Church, 1887; Williams Hall, 1902; Drown Memorial Hall, 1907; the University Commons, 1907; the Wilbur Heating Plant and Engineering Laboratory, 1907; Taylor Hall, 1907; Sayre Park, 1909; Coxe Mining Laboratory, 1910; Fritz Engineering Laboratory, 1910; Taylor Gymnasium and Taylor Field, 1913.

Lehigh University offers the following courses:

COLLEGE OF ARTS AND SCIENCE:

1. The Course in Arts and Science.

COLLEGE OF BUSINESS ADMINISTRATION:

1. The Course in Business Administration.

COLLEGE OF ENGINEERING:

1. The Course in Civil Engineering.
2. The Course in Mechanical Engineering.
3. The Course in Metallurgy.
4. The Course in Mining Engineering.
5. The Course in Electrical Engineering.
6. The Course in Chemistry.
7. The Course in Chemical Engineering.
8. The Course in Ship Construction and Marine Transportation.

Courses are described in detail on pages 31 to 75.

REQUIREMENTS FOR ADMISSION

Candidates for admission to Lehigh University must be at least sixteen years of age, must present testimonials of good moral character, and must be qualified in the entrance subjects as enumerated below.

THE COLLEGE OF ARTS AND SCIENCE

(a) Candidates for admission must present entrance requirements as follows:*

	Units
English,	3
History,	1
Elementary Algebra, A and B,	1½
Plane Geometry,	1
Latin A and B or German A or	
French A or Spanish A,	2
	<hr/> 8½

(b) Candidates must present besides the subjects in (a), 6½ units from the following:

	Units
Advanced Algebra,	½
Solid Geometry,	½
Plane Trigonometry and Logarithms,	½
Latin,	2, 3 or 4
French,	1, 2 or 3
German,	1, 2 or 3
Spanish,	1, 2 or 3
American History,	1
Ancient History,	1
Modern History,	1
English History,	1
Physics,	1
Chemistry,	1
Zoölogy,	½ or 1
Botany,	½ or 1
Physiology and Hygiene,	½ or 1
Physiography,	½ or 1
Unassigned,	½ or 1

Detailed information concerning these subjects is given on pages 20 to 27.

*A unit represents a year's study in any subject in a secondary school, constituting approximately a quarter of a full year's work. A four-year secondary school curriculum should be regarded as representing not more than sixteen units of work.

THE COLLEGE OF BUSINESS ADMINISTRATION

(a) Candidates must present the following subjects:

	Units
English,	3
History,	1
Elementary Algebra, A and B,	1½
Plane Geometry,	1
German A or French A or	
Spanish A or Latin A and B,	2
	<hr/>
	8½

(b) Candidates must present besides the subjects in (a), 5½ units from the following:

	Units
Advanced Algebra,	½
Solid Geometry,	½
Plane Trigonometry and Logarithms,	½
Latin,	2, 3 or 4
French A or German A or Spanish A,	2
American History,	1
Ancient History,	1
Modern History,	1
English History,	1
Freehand Drawing,	½
Mechanical Drawing,	½
Physics,	1
Elementary Chemistry,	1
Zoölogy,	½ or 1
Botany,	½ or 1
Physiology and Hygiene,	½ or 1
Physiography,	½ or 1
Manual Training,	½ or 1
Bookkeeping, Stenography and	
Typewriting,	1 or 2
Industrial History,	1
Civics,	1
Economics,	1
Sociology,	1
Commercial Geography,	1

Detailed information concerning these subjects is given on pages 20 to 27.

THE COLLEGE OF ENGINEERING

(a) Candidates for admission to the Courses in Civil Engineering, Mechanical Engineering, Metallurgical Engineering, Mining Engineering, Electrical Engineering, Chemistry, Chemical Engineering, and Ship Construction and Marine Transportation must present the following subjects:

	Units
English,	3
History,	1
Elementary Algebra, A and B,	1½
Plane Geometry,	1
Solid Geometry,	½
Plane Trigonometry and Logarithms,	½
German A or French A or Spanish A,	2
	<hr/> 9½

(b) Candidates must present besides the subjects in (a), 4½ units from the following:

	Units
Advanced Algebra,	½
Latin,	2, 3 or 4
Greek,	2 or 3
German,	2 or 3
French,	2 or 3
Spanish,	2 or 3
American History,	1
Ancient History,	1
Modern History,	1
English History,	1
Freehand Drawing,	½
Mechanical Drawing,	½
Physics,	1
Elementary Chemistry,	1
Zoölogy,	½ or 1
Botany,	½ or 1
Physiology and Hygiene,	½ or 1
Physiography,	½ or 1
Manual Training,	½ or 1

Detailed information concerning these subjects is given on pages 20 to 27.

The detailed requirements in the various subjects are as follows:

ENGLISH

Preparation in English has three main objects: (a) command of correct and clear English, spoken and written; (b) ability to use the vernacular with accuracy and appreciation; and (c) some acquaintance with the simpler English classics.

ENGLISH GRAMMAR AND COMPOSITION. The first two objects require instruction in grammar and composition. English grammar should be reviewed in the secondary school; and correct spelling and grammatical accuracy should be rigorously exacted in connection with all written work during the four years. The principles of English composition governing punctuation, the use of words, paragraphs, and the different kinds of composition, including letter writing, should be thoroughly mastered; and practice in composition, oral as well as written, should extend throughout the secondary school period. Written exercises may well comprise narration, description, and easy exposition based upon the principles of elementary rhetoric, as given in any approved High School Rhetoric. It is advisable that subjects for this work be taken from the student's personal experience, general knowledge, and studies other than English, as well as from his reading in literature. Finally, special instruction in language and composition should be supported by concerted efforts of teachers in all branches to cultivate in the student the habit of using good English in his recitations and various exercises, whether oral or written, making every recitation in some degree an exercise in English.

LITERATURE. The third object is sought by means of two lists of books, headed respectively *reading* and *study*; from which may be framed a progressive course in literature covering four years. In connection with both lists, the student should be trained in reading aloud and be encouraged to commit to memory some of the more notable passages both in verse and in prose.

The books for reading and study are to be selected from the groups suggested by the Conference on Uniform Entrance Requirements in English.

3 units.

HISTORY

The requirement in History is based on the recommendation of the Committee of Seven of the American Historical Association.

ANCIENT HISTORY, with special reference to Greek and Roman History, and including also a short introductory study of the more ancient nations and the chief events of the early Middle Ages, down to the death of Charlemagne (814). 1 unit.

MEDIAEVAL AND MODERN EUROPEAN HISTORY, from the death of Charlemagne to the present time. 1 unit.

ENGLISH HISTORY, with due reference to social and political development. 1 unit.

AMERICAN HISTORY AND CIVIL GOVERNMENT, with due reference to social and political development. 1 unit.

The examinations in history will be so framed as to require comparison and the use of judgment on the pupil's part rather than the mere use of memory. The examinations will presuppose the use of good text-books, collateral reading, and practice in written work. Geographical knowledge will be tested by requiring the location of places and movements on an outline map. 1 unit.

MATHEMATICS

ELEMENTARY ALGEBRA, A (ALGEBRA TO QUADRATICS). The four fundamental operations for rational algebraic expressions. Factoring, determination of highest common factor and lowest common multiple by factoring. Fractions, including complex fractions, and ratio and proportion. Linear equations, both numerical and literal, containing one or more unknown quantities. Problems depending on linear equations. Radicals, including the extraction of the square root of polynomials and of numbers. Exponents, including the fractional and negative. 1 unit.

ELEMENTARY ALGEBRA, B (QUADRATICS AND BEYOND). Quadratic equations, both numerical and literal. Simple cases of equations with one or more unknown quantities, that can be solved by the methods of linear or quadratic equations. Problems depending on quadratic equations. The binomial theorem for positive integral exponents. The formulas for the n th term and the sum of the terms of arithmetic and geometric progressions with applications. $\frac{1}{2}$ unit.

ADVANCED ALGEBRA. Permutations and combinations, limited to simple cases. Complex numbers, with graphical representation of sums and differences. Determinants, chiefly of the second, third, and fourth orders, including the use of minors and the solution of linear equations. Numerical equations of higher degree, and so much of the theory of equations, with graphical methods, as is necessary for their treatment, including Descartes's rule of sign and Horner's method, but not Sturm's functions or multiple roots. $\frac{1}{2}$ unit.

PLANE GEOMETRY. The usual theorems and constructions of good text-books, including the general properties of plane rectilinear figures; the circle and the measurement of angles; similar polygons; areas; regular polygons and the measurements of the circle. The solution of numerous original exercises, including loci problems. Applications to the mensuration of line and plane surfaces. 1 unit.

SOLID GEOMETRY. The usual theorems and constructions of good text-books, including the relations of planes and lines in space; the properties and measurements of prisms, pyramids, cylinders and cones; the sphere and the spherical triangle. The solution of numerous original exercises, including loci problems. Application to the mensuration of surfaces and solids. $\frac{1}{2}$ unit.

PLANE TRIGONOMETRY. Definitions and relations of the six trigonometric functions as ratios; circular measurement of angles. Proofs of principal formulas, in particular for the sine, cosine, and tangent of the sum and the difference of two angles, of the double angle and the half angle, the product expressions for the sum or the difference of two sines or of two cosines, etc.; the transformation of trigonometric expressions by means of these formulas. Solution of trigonometric equations of a simple character. Theory and use of logarithms (without the introduction of work involving infinite series). The solution of right and oblique triangles and practical applications. Candidates must bring their logarithmic tables to the examination. $\frac{1}{2}$ unit.

Candidates must have a knowledge of the metric system and be prepared to solve problems in either Algebra or Geometry involving the use of the metric system.

PHYSICS

The course of instruction in Physics should include:

(a) The study of some standard text-book, for the purpose of obtaining a connected view of the subject; (b) instruction by lecture table demonstrations, to be used mainly for illustration of the facts and phenomena of physics; (c) individual laboratory work consisting of at least thirty experiments.

The aim of laboratory work should be to supplement the pupil's fund of concrete knowledge and to cultivate his power of accurate observation and clearness of thought and expression. The exercises should be chosen with a view to furnishing forceful illustrations of fundamental principles and their practical applications. They should be such as to yield results capable of ready interpretation, obviously in conformity with theory, and free from the disguise of unintelligible units.

1 unit.

GERMAN

ELEMENTARY GERMAN, A. This requirement follows, in the main, the recommendation of the Committee of Twelve of the Modern Language Association. It is expected that two whole years will be given to the work.

During the first year the work should comprise:

1. Careful drill in pronunciation.
2. The memorizing and frequent repetition of easy colloquial sentences.
3. Drill upon the rudiments of grammar, that is, upon the inflection of the articles, of such nouns as belong to the language of every-day life, of adjectives, pronouns, weak verbs and the more usual strong verbs; also upon the use of the more common prepositions, the simpler uses of the modal auxiliaries and the elementary rules of syntax and word-order.
4. Abundant easy exercises, designed not only to fix in mind the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression.
5. Reading of from 75 to 100 pages of graduated texts from a reader, with constant practice in translating into German easy variations upon sentences selected from the reading lesson (the teacher giving the English), and in the reproduction from memory of sentences previously read.

During the second year the work should comprise:

1. The reading of from 150 to 200 pages of literature in the form of easy stories and plays.

2. Accompanying practice, as before, in the translation into German of easy variations upon the matter read and in the off-hand reproduction, sometimes orally and sometimes in writing, of the substance of short and easy selected passages.

3. Continued drill in the rudiments of the grammar, directed to the ends of enabling the pupil, first, to use his knowledge with facility in the formation of sentences, and secondly, to state his knowledge correctly in the technical language of grammar.

2 units.

INTERMEDIATE GERMAN, B. This work should comprise, in addition to the elementary course, the reading of about 400 pages of moderately difficult prose and poetry, with constant practice in giving, sometimes orally and sometimes in writing, paraphrases, abstracts, or reproductions from memory of selected portions of the matter read; also grammatical drill upon the less usual strong verbs, the use of articles, cases, auxiliaries of all kinds, tenses and modes (with special reference to the infinitive and the subjunctive), and likewise upon word order and word formation.

1 unit.

FRENCH

ELEMENTARY FRENCH, A. This requirement follows, in the main, the recommendation of the Committee of Twelve of the Modern Language Association. It is expected that two whole years will be given to the work.

During the first year the work should comprise:

1. Careful drill in pronunciation.

2. The rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles and pronouns; the use of personal pronouns, common adverbs, prepositions and conjunctions; the order of words in the sentence and the elementary rules of syntax.

3. Abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression.

4. The reading of from 100 to 175 pages of graduated texts, with constant practice in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read.

5. Writing French from dictation.

During the second year the work should comprise:

1. The reading of from 250 to 400 pages of easy modern prose in the form of stories, plays or historical or biographical sketches.

2. Constant practice, as in the previous year, in translating into French easy variations upon the texts read.

3. Frequent abstracts, sometimes oral and sometimes written, of portions of the text already read.

4. Writing French from dictation.

5. Continued drill upon the rudiments of grammar, with constant application in the construction of sentences.

6. Mastery of the forms and uses of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive. 2 units.

INTERMEDIATE FRENCH, B. This should comprise the reading of from 400 to 600 pages of French of ordinary difficulty, a portion to be in the dramatic form; constant practice in giving French paraphrases, abstracts or reproductions from memory of selected portions of the matter read; the study of a grammar of moderate completeness; writing from dictation.

1 unit.

SPANISH

ELEMENTARY SPANISH, A. Two years' preparation, covering the following ground:

1. Drill in correct production of Spanish sounds.

2. The rudiments of grammar, illustrated by abundant easy exercises.

3. The reading of about 150 pages of graduated texts with constant translating into Spanish of easy variations of sentences read, the teacher giving the English.

4. Aural Drill. Practice in translating into English of Spanish words, clauses and sentences heard but not seen, the teacher giving the Spanish.

During the second year:

1. Reading of 250 to 400 pages of easy modern prose.

2. Constant practice in translating into Spanish easy variations upon the texts read.

3. Aural practice and drill in pronunciation.

4. Mastery of the form and uses of pronouns, of the subjunctive mode and of the forms of the radical changing verbs.
2 units.

INTERMEDIATE SPANISH, B. The reading of not less than 500 additional pages of Spanish prose together with the translation of at least 40 pages of simple connected English prose into Spanish.
1 unit.

LATIN

The following requirements in Latin are in accordance with the recommendation made by the American Philological Association, October, 1909.

LATIN, A and B. First and Second Year Latin. Grammar, Elementary Prose Composition. Reading of an amount not less than Cæsar, *Gallic War*, I-IV, selected by the schools from Cæsar *Gallic War* and *Civil War*) and Nepos (*Lives*). 2 units.

LATIN, C. Third Year Latin. Reading of an amount not less than Cicero, *Orations against Catiline*, *For the Manilian Law*, and *For Archias*, selected by the schools from Cicero (*Orations*, *Letters* and *De Senectute*) and Sallust (*Catiline* and *Jugurthine War*).
1 unit.

LATIN, D. Fourth Year Latin. Reading of an amount not less than Vergil, *Aeneid*, I-VI, selected by the schools from Vergil (*Aeneid*, *Bucolics*, and *Georgics*) and Ovid (*Metamorphoses*, *Fasti*, *Tristia*, *Amores*).
1 unit.

GREEK

The following requirements in Greek are selected in as close accordance as is practicable with the recommendations of the American Philological Association.

GREEK. Grammar; Elementary Prose Composition, consisting principally of detached sentences to test the candidate's knowledge of grammatical construction; Xenophon: the first four books of the *Anabasis*; the translation, at sight, of a passage from some work of Xenophon.
2 units.

GREEK, Homer's *Iliad*, I-III: The first three books of the *Iliad* (omitting II, 494-end), and the Homeric forms, constructions and prosody.
1 unit.

CHEMISTRY

The requirement in Chemistry is based on the report of the Committee on Chemistry of the Science Department of the National Educational Association.

ELEMENTARY CHEMISTRY. It is recommended that the candidate's preparation in chemistry include: (a) individual laboratory work, comprising at least forty exercises; (b) instruction by lecture table demonstrations, to be used mainly as a basis for questioning upon the general principles involved in the pupil's laboratory investigations; (c) the study of at least one standard text book, to the end that the pupil may gain a comprehensive and connected view of the most important facts and laws of elementary chemistry. 1 unit.

Students, properly qualified, will be examined in Elementary Chemistry on the first Saturday of the term; those passing the examination will be privileged to omit Elementary Chemistry (390) and will, instead, take Chemistry (393) during the first term.

DRAWING

FREEHAND DRAWING. Sketching of simple geometrical figures, of objects, and from copy. At least twenty plates must be submitted. $\frac{1}{2}$ unit.

MECHANICAL DRAWING. The use of instruments and the preparation of at least twenty plates, illustrating the elements of descriptive geometry or simple machine parts. $\frac{1}{2}$ unit.

PHYSIOGRAPHY

PHYSIOGRAPHY. The study of a standard text-book in physical geography, that a knowledge may be gained of the essential principles, and of well-selected facts illustrating those principles. Individual laboratory work, comprising at least forty exercises with notebook, is recommended.

$\frac{1}{2}$ or 1 unit.

BOTANY

BOTANY. An amount equal to that contained in Bergen's *Foundations of Botany* with laboratory work. $\frac{1}{2}$ or 1 unit.

PHYSIOLOGY AND HYGIENE

PHYSIOLOGY AND HYGIENE. A course covering approximately what is given in such a text-book as Huxley & Youman's *Physiology and Hygiene*. $\frac{1}{2}$ or 1 unit.

ZOOLOGY

ZOOLOGY. The equivalent of Jordan, Kellogg & Heath's *Animal Studies* with laboratory work. $\frac{1}{2}$ or 1 unit.

MANUAL TRAINING

MANUAL TRAINING. Shop work in wood or metal in schools giving courses in manual training. $\frac{1}{2}$ or 1 unit.

BOOKKEEPING, TYPEWRITING AND STENOGRAPHY

BOOKKEEPING, TYPEWRITING AND STENOGRAPHY, covering a formal course of study at school. 1 or 2 units.

DATES OF EXAMINATIONS

Examinations for admission to the University are held in June and September in the following order:

First Day.—Geometry, 8 A.M.; Physics, Ancient History, 2 P.M.

Second Day.—Elementary Algebra, A, 8 A.M. to 10 A.M., Elementary Algebra, B, 10 A.M. to 12 M.; Trigonometry, 2 P.M.

Third Day.—Latin, 8 A.M.; German, French, Spanish, Greek, 2 P.M.

Fourth Day.—English, 8:30 A.M.; History, 2 P.M.

The dates for 1921 and 1922 are as follows: in 1921, Wednesday, Thursday, Friday and Saturday, June 15, 16, 17, and 18; and Friday, Saturday, Monday and Tuesday, September 16, 17, 19 and 20; in 1922, June 14, 15, 16 and 17, and September 15, 16, 18 and 19.

Examinations in subjects presented for elective units may be arranged for by correspondence with the Registrar.

Candidates for admission wishing to take examinations in any advanced subject for credit should notify the Registrar before September 1.

Certificates of the College Entrance Examination Board are accepted instead of the entrance examinations held at the University in those subjects in which the recorded grade is 60 per cent. or over.

ADMISSION TO ADVANCED STANDING

Candidates for admission to advanced studies in any course must, in addition to meeting entrance requirements, pass examinations in the work already done by the classes which they desire to enter. These examinations are held in September according to a fixed schedule, in the week preceding the opening of the University.

A student from another college or university is admitted without entrance examinations, provided he has covered the entrance subjects required at this University and has attended another college or university for one or more complete terms. Evidence to that effect should be filed with the Registrar. If a student has been dropped from another college or university, he must present his record to the Committee on Standing of Students and his admission will largely depend upon the record he made in the institution from which he was dropped.

Applicants who have obtained a certificate that the entrance requirements of the University are satisfied are advised to report personally to the Secretary of the Faculty. The Secretary of the Faculty will issue to the applicant a paper authorizing him to confer with the professors regarding the subjects for which he desires credit. It is necessary for an applicant to bring a certificate naming the subjects completed at another college, together with a copy of the catalogue or register of the college; and it is desirable for him to bring his drawings, field notes, computations and laboratory notebooks for inspection, and personal certificates from his teachers showing the grades attained at the college from which he comes. Professors may admit the student to advanced standing if satisfied with these evidences of proficiency, or they may require formal examinations in the subjects for which he desires credits.

Professors will note their conclusions on the paper furnished the applicant, and he will return it to the Secretary of the Faculty within the time specified on its face. If all the subjects are accepted the applicant will be admitted in full standing to the Freshman, Sophomore, or Junior Class, as the case may be. If nearly all are accepted, the candidate may be admitted with conditions, and the Secretary of the Faculty will inform him of the rules applicable to conditioned students.

Graduates of other colleges having the Bachelor's degree or its equivalent are similarly admitted to engineering courses. The length of time for the completion of a course will depend upon the student's attainments at entrance and his ability. Every opportunity will be given for the completion of a course in minimum time.

A student who anticipates taking a technical course at Lehigh University after graduation from college should so

arrange his work in college as to cover as many as possible of the subjects of the Freshman and Sophomore years of the technical course he intends to enter.

ADMISSION TO GRADUATE COURSES

Graduates of Lehigh University and others having satisfactory degrees conferred elsewhere may be admitted to advanced studies as outlined on page 135.

SCHOOL CERTIFICATES

Lehigh University has no permanent arrangement with any school whereby certificates are accepted instead of entrance examinations.

Applicants for admission on certificate should request their school principals to send to the Registrar as soon as the school closes in June a complete record of their work. Blanks for this purpose are supplied by the University.

Certificates are accepted in subjects in which records are satisfactory to the professors concerned and in which the work has been completed within reasonable time limits.

For admission to the College of Engineering records in mathematical subjects are accepted only if there is evidence of some satisfactory school study of mathematics completed not earlier than January of the entrance year.

For admission to the College of Arts and Science and to the College of Business Administration records in mathematical subjects are accepted only if there is evidence of some satisfactory school study of mathematics completed not earlier than June of the year preceding the entrance year.

For admission to the College of Engineering, to the College of Arts and Science and to the College of Business Administration records in the required foreign language are accepted only if there is evidence of some satisfactory school study of the language completed not earlier than January of the year preceding the entrance year.

EXAMINATIONS AT SCHOOLS

Upon the request of school principals the June entrance examinations may be held at schools on the regularly scheduled dates. Requests for examination papers should be sent to the Registrar before June 1.

THE COLLEGE OF ARTS AND SCIENCE

The College of Arts and Science of Lehigh University represents the traditional college course, modified to meet the needs of modern life and thought. Such a course is, in its purpose, primarily informing and cultural, not vocational; it seeks to gratify intellectual curiosity, to cultivate a love of learning, to impart the knowledge and discipline which are essential to intelligent and forceful living. It has besides certain specific uses: it is the customary approach to the professions of medicine, law, theology and teaching, and the usual basis for graduate study for higher degrees.

The entrance requirements are liberal, and such as may be met readily by graduates of Pennsylvania high schools of the first class. A statement of them may be found on page 17.

The plan of study comprises required subjects and unassigned or elective subjects. The required and elective subjects occupy respectively about two-thirds and one-third of the course. The required studies embrace courses in the English, German and French languages and literatures (two years each), mathematics, (trigonometry and solid geometry), chemistry (elementary chemistry and qualitative analysis), economics, history, psychology, biology, geology, and philosophy, subjects which may be regarded as fundamental to the nature and purpose of the course.

The studies of the Freshman year follow in general the subjects which have been presented for entrance. After the Freshman year the course becomes increasingly elective, a minimum of three hours weekly of electives being allowed in the Sophomore year, six in the Junior year and ten in the Senior year. An appointed member of the Faculty counsels students in the choice of their studies and keeps before them the importance of selecting their work according to a definite and consecutive plan. Students are dealt with individually rather than in groups, and the effort is made to suit the studies of each to his qualifications and purpose.

The minimum course of study comprises fifteen scholastic hours or periods weekly. Work is assigned on the assumption that two hours are required by the average student to prepare adequately for a recitation. Students of proved ability, how-

ever, are not limited to this minimum after the Freshman year, and even in that year an entering student may increase his course in chemistry from three to four hours, if, as in the case of those who are preparing for the study of medicine, there is good reason. In general, the College aims at a reasonable amount of work well done, rather than a large amount indifferently done.

Instruction is given by lectures, by recitations, by the assignments of readings and topics for study and dissertations, and, when the subject admits of it, by practical work in field or laboratory. Field work or laboratory work accompanies courses in geology, physics, chemistry, biology, psychology, and allied subjects; students in advanced mathematics use, in their study of astronomy, the telescope and other instruments of the Sayre Observatory. Practice in teaching is provided in the schools of the vicinity and in the Lehigh Evening School for those who expect to follow teaching. Students residing at Leonard Hall who are preparing, under the direction of the Bishop of the Episcopal Diocese of Bethlehem, for the theological seminary have opportunity for practical religious work.

In the following plan of study the unassigned hours are filled by subjects selected from the listed elective studies. These are not necessarily confined to the year to which in the lists they are assigned, but may be taken earlier or subsequently. But this privilege is limited by considerations of the roster and the principle that the course of each student shall be systematic and not haphazard.

Students who enter with full entrance requirements in Latin and Greek (four and three units) will ordinarily continue these studies during the Freshman year. A class in Beginners' Greek, open to Freshmen and Sophomores, is formed in alternate years. Students who begin Greek in College will ordinarily pursue the study of Greek for three years.

The degree of Bachelor of Arts (B.A.) is conferred upon graduates of the College of Arts and Science.

SCHEDULE OF STUDIES OF THE B.A. COURSE

FIRST TERM	FRESHMAN YEAR		SECOND TERM
English (3)	120, 121	English (3)	122, 125
Plane Trigonometry (3)	141	Solid Geometry (3)	140
German (3)	77 or 70	German (3)	77 or 71
or French (3)	98	or French (3)	99
Latin (3)	45	Latin (3)	46
or Ancient Lit. and History (3)	47	or Mediaeval Lit. and History	47
Greek (3)	55 or 64	Greek (3)	56 or 64
or } Chemistry (2)	390	or Chemistry (3)	395
or } Chemical Lab. (1)	392	Mil. Sci. & Tactics (2)	470
Mil. Sci. & Tactics (2)	470	Military Drill (½)	470
Military Drill (½)	470	Gymnasium (½)	500
Gymnasium (½)	500		

FIRST TERM	SOPHOMORE YEAR	SECOND TERM	
English Literature (2)	123	English Literature (2)	124
English Writing (1)		English Writing (1)	
Economics (3)	16	Economics (3)	17
Latin (3)	48	Latin (3)	49
or Greek (3)	57	or Greek (3)	58
or Physics (3)	327	or Physics (3)	327
German (3)	78 or 77	German (3)	79 or 77
or French (3)	100	or French (3)	101
Physical Education (½)	500	Physical Education (½)	500
Mil. Sci. & Tactics (2)	471	Mil. Sci. & Tactics (2)	471
Military Drill (½)	471	Military Drill (½)	471
Unassigned (3)+		Unassigned (3)+	

FIRST TERM	JUNIOR YEAR	SECOND TERM	
Psychology (3)	1	Psychology (3)	1
French (3)	90 or 98	French (3)	90 or 99
or German (3)	70	or German (3)	71
Biology (3)	292	General Geology (2)	268
Physical Education (1)	500	Geological Lab. and	
Unassigned (6)+		Field Trips (1)	269
		Physical Education (1)	500
		Unassigned (6)+	

FIRST TERM		SENIOR YEAR		SECOND TERM	
Philosophy (2)	7	Philosophy (2)	8		
French (3)	97 or 100	French (3)	97 or 101		
or German (3)	77	or German (3)	77		
Physical Education (1)	500	Physical Education (1)	500		
Unassigned (10)+		Unassigned (10)+			

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

ELECTIVE STUDIES

In order that elective subjects may be incorporated, so far as possible, in the University roster from term to term without conflicts, students are required to submit their electives to the Professor in charge of electives, for the first term on or before May 1, for the second term on or before December 15.

FIRST TERM	SOPHOMORE ELECTIVES		SECOND TERM
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145
Mod. European History (3)	41	Mod. European History (3)	41
Elementary Mechanics (3)	320	Elementary Mechanics and	
Latin (3)	48	Heat (3)	321
Greek (3)	64 or 65	Latin (3)	49
Chemical Philosophy (3)	398	Greek (3)	64 or 65
Economic Geography (3)	35	Advanced Chemistry (3)	399
Physiography (3)	277	Economic Geography (3)	35
French (3)	92	Physiography (3)	278
or German (3)	70	French (3)	92
History of Education (3)	10	or German (3)	71
		Scientific Method (3)	19
		Physical Measurements (1)	322
		Spherical Trigonometry (1)	142

FIRST TERM	JUNIOR ELECTIVES		SECOND TERM	
U. S. History (3)	39	U. S. History (3)	39	
Latin (3)	50 or 52	Latin (3)	51 or 53	
Greek (3)	55, 59 or 61	Greek (3)	56, 60 or 62	
French (3)	98, 100 or 102	French (3)	99, 101 or 102	
or German (3)	79, 77 or 76	or German (3)	79, 78 or 76	
Spanish (3)	110	Spanish (3)	110	
Differential Calculus & Solid Analytic Geom. (4)	146	Integral Calculus (4)	147	
Elec. & Magnetism (3)	323	Light & Sound (3)	325	
Mech. & Heat Lab. (1)	324	Light, Elec. & Mag. Lab. (1)	326	
Quantitative Analysis (4)	401	Quantitative Analysis (4)	403	
Constitutional Law (3)	33	Constitutional Law (3)	33	
English (3)	126	Comparative Anatomy (3)	293	
Mineralogy (4)	266	English (3)	128	
Education (3)	10 or 11	Education (3)	11	
Italian (3)	116	Italian (3)	116	
Economic Geography (3)	35	Economic Geography (3)	35	
Business Law (2)	31	Business Law (2)	32	
Labor Legislation (2)	23	Labor Legislation (2)	23	
		Geological Lab. (2)	269	

FIRST TERM	SENIOR ELECTIVES	SECOND TERM	
U. S. History (3)	40	U. S. History (3)	40
Latin (3)	50 or 52	Latin (3)	51 or 53
Greek (3)	57, 59 or 61	Greek (3)	58, 60 or 62
German (3)	80 or 81	German (3)	80 or 81
French (3)	100, 102, 103 or 104	French (3)	100, 102, 103 or 104
Italian (3)	117	Italian (3)	117
Spanish (3)	112	Spanish (3)	112
Organic Chemistry (5)	408	Organic Chemistry (5)	408, 409
Banking (3)	27	Banking (3)	27
Education (3)	11	Education (3)	11
Embryology (3)	294	Botany (2)	290
Bacteriology (2)	296	Physiology (2)	298
Mental Hygiene (2)	3	Advanced Bacteriology (2)	297
Finance (3)	18	Social Psychology (2)	4
International Law (3)	34	Finance (3)	19
English (3)	130 or 132	International Law (3)	34
Physics (3)	332	English (3)	131 or 134
Analytic Mechanics (2)	149	Physics (3)	332
Field Geology (3)	275	Astronomy (3)	150
Petrography (2)	276	Palaeontology (3)	272
Differential Equations (1)	148	Geology of N. A. (3)	273
Adv. Electricity &		Electrical Laboratory (1)	330
Magnetism (2)	328	Analytic Mechanics (3)	152
Electrical Laboratory (1)	329		

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

PREPARATION FOR ENGINEERING COURSES

If a student in the College of Arts and Science contemplates becoming a candidate for a degree in technology after completion of his B.A. course, he should choose as electives during the third and fourth years of his B.A. course such science studies as are contained in the first and second years of the technical course which he wishes afterwards to complete. By carefully selecting electives, with the advice and guidance of the head of his department and the professor in charge of the technical course concerned, the graduate of the B.A. course may enter the technical course chosen as a Junior in full standing, and obtain his technical degree in two years of further study.

PRE-MEDICAL COURSES

Certain medical schools require for entrance a full college course in addition to a high school course; others require a high school course yielding fourteen or more college entrance credits and at least two years in a college of liberal arts with

three-fourths of the study devoted to chemistry, physics and biology.

Corresponding to these two classes of entrance requirements the University offers the two appended plans of study, of which the second is designed for those who will spend but two years in college in preparation for the study of medicine, the first for those who will complete the college course and obtain their degree. Since the number of students which medical colleges of standing can accommodate is limited, practical considerations alone make advisable the fullest preparation one can command. It should also be remembered that no profession comes into closer touch with humanity than medicine, that to none is wide and accurate knowledge more essential, and that for its study no preparation can be too good.

SCHEDULE OF FOUR-YEAR PRE-MEDICAL COURES

FIRST TERM		FRESHMAN YEAR		SECOND TERM	
English (3)	120, 121	English (3)	122, 125		
Plane Trigonometry (3)	141	Solid Geometry (3)	140		
German (3)	77 or 70	German (3)	77 or 71		
or French (3)	98	or French (3)	99		
Latin (3)	45	Latin (3)	46		
or Ancient Lit. & History (3)	47	or Mediaeval Lit. & History (3)	47		
Elementary Chemistry (2)	390	Qualitative Anal. (3)	395		
Chemistry Lab. (2)	391	Stoichiometry (1)	397		
Mil. Sci. & Tactics (2)	470	Mil. Sci. & Tactics (2)	470		
Military Drill ($\frac{1}{2}$)	470	Military Drill ($\frac{1}{2}$)	470		
Gymnasium ($\frac{1}{2}$)	500	Gymnasium ($\frac{1}{2}$)	500		

FIRST TERM		SOPHOMORE YEAR		SECOND TERM	
English (3)	123, 129	English (3)	124, 133		
German (3)	78 or 77	German (3)	79 or 77		
or French (3)	100	or French (3)	101		
Economics (3)	16	Economics (3)	17		
Physics (3)	327	Physics (3)	327		
Chemical Philosophy (3)	393	Advanced Chemistry (3)	399		
Mil. Sci. & Tactics (2)	471	Mil. Sci. & Tactics (2)	471		
Military Drill ($\frac{1}{2}$)	471	Military Drill ($\frac{1}{2}$)	471		
Physical Education ($\frac{1}{2}$)	500	Physical Education ($\frac{1}{2}$)	500		

FIRST TERM		JUNIOR YEAR		SECOND TERM	
Psychology (3)	1	Psychology (3)	1		
French (3)	90	French (3)	90		
or German (3)	70	or German (3)	71		
Biology (3)	292	Geology (3)	268, 269		
Quantitative Anal. (4)	400, 402	Comparative Anatomy (3)	293		
Theoretical Physics (2)	332	Botany (3)	290		
Physical Education (1)	500	Physics (2)	332		
		Physical Education (1)	500		

FIRST TERM		SENIOR YEAR		SECOND TERM	
Philosophy (2)	7	Philosophy (2)	8		
French (3)	97	French (3)	97		
or German (3)	77	or German (3)	77		
Organic Chemistry (5)	408, 409	Organic Chemistry (5)	410, 411		
Embryology (3)	294	Physiology (2)	298		
Bacteriology (2)	296	Psychology (3)	4, 6		
Physical Education (1)	500	Physical Education (1)	500		

SCHEDULE OF TWO-YEAR PRE-MEDICAL COURSE

FIRST TERM		FIRST YEAR		SECOND TERM	
English (3)	120, 121	English (3)	122, 125		
German (3)	77 or 70	German (3)	77 or 71		
or French (3)	98	or French (3)	99		
Plane Trigonometry (3)	141	Solid Geometry (3)	140		
Physics (3)	327	Physics (3)	327		
Elementary Chemistry (2)	390	Qualitative Anal. (3)	395		
Chemistry Lab. (2)	391	Stoichiometry (1)	397		
Mil. Sci. & Tactics (2)	470	Mil. Sci. & Tactics (2)	470		
Military Drill ($\frac{1}{2}$)	470	Military Drill ($\frac{1}{2}$)	470		
Gymnasium ($\frac{1}{2}$)	500	Gymnasium ($\frac{1}{2}$)	500		

FIRST TERM		SECOND YEAR		SECOND TERM	
English (3)	123, 129	English (3)	124, 133		
German (3)	78 or 77	German (3)	79 or 77		
or French (3)	100	or French (3)	101		
Organic Chemistry (5)	408, 409	Comparative Anatomy (3)	293		
Biology (3)	292	Botany (3)	290		
Psychology (3)	1	Psychology (3)	4, 6		
Physics (2)	332	Physics (2)	332		
Mil. Sci. & Tactics (2)	471	Mil. Sci. & Tactics (2)	471		
Military Drill ($\frac{1}{2}$)	471	Military Drill ($\frac{1}{2}$)	471		
Physical Education ($\frac{1}{2}$)	500	Physical Education ($\frac{1}{2}$)	500		

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

COURSES FOR TEACHERS

In the course leading to the degree of Bachelor of Arts, outlined on pages 31-35, the student may, through a selection of suitable electives, equip himself to teach in the high school the subject or subjects he has selected as his specialty, whether in the field of English, of ancient or modern language, of history, of biology and chemistry, of physics and mathematics, or of physiography and related subjects. In the course in Business Administration he is permitted to substitute, during the Junior and Senior years, courses in distinctly pedagogical subjects sufficient to make a total of fifteen term hours. He may thus equip himself to teach in secondary schools the important branches of commerce and industry.

No one may teach in the public schools of any state without first securing a license from that state. In Pennsylvania, as in most states, the special examination for such a license is waived in the case of college graduates, provided they have completed a certain number of hours in distinctly pedagogical studies, and have applied for a provisional college certificate to teach. At the end of three years of successful experience in teaching the State of Pennsylvania issues a permanent college certifi-

cate. The requirement in this State for a provisional certificate calls for 200 recitation hours in such studies as psychology, history of education, school management, methods of teaching, logic and ethics. The wish is general, however, among superintendents and principals that the graduate, when he begins to teach, shall have completed a much larger amount of distinctly pedagogical study than the law now demands, and that he shall have had some experience in observation and practice teaching.

Lehigh has endeavored to meet this wish. The University Department of Education has worked out a system of giving students opportunities in observation and practice teaching. Through the courtesy and liberal spirit of Boards of Education and Superintendents of Public Schools, through the University's close association with private schools, and through the work of the Lehigh Evening School, the system of practice teaching has been made in a measure adjustable to the needs of students with different aims and at different stages in their development of teaching power.

The course in Education at Lehigh may be outlined as follows:

FIRST TERM		SOPHOMORE YEAR	SECOND TERM	
History of Education (3)	10	Scientific Method (3)	9	
FIRST TERM		JUNIOR YEAR	SECOND TERM	
General Psychology (3)	1	General Psychology (3)	1	
Secondary Education (3)	11	Secondary Education (3)	11	
FIRST TERM		SENIOR YEAR	SECOND TERM	
Special Method (3)	12	Special Method (3)	12	

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

The courses in Psychological Problems, Social Psychology and History of Philosophy also throw considerable light upon the true purposes of education and the methods by which to secure them.

Graduates from state normal schools will, under the conditions prescribed by the State Department of Education, receive credit for equivalent studies in the field of education completed in the normal schools.

THE COLLEGE OF BUSINESS ADMINISTRATION

Requirements for admission to the College of Business Administration are given on page 18.

The aim of the Course in Business Administration is to provide a sound understanding of the structure, organization and functioning of industry, commerce and finance, and of the general causes and criteria of prosperity and depression. A study is made of the functions common to all business enterprises and of the general principles of administration. The student is shown the relation of the business executive to the various factors of business organization and control.

In addition to providing a broad training for business, this course gives opportunity to specialize in some one branch of business and to prepare for the study of law and for public service. The following groupings of subjects suggest the opportunities for specialized work:

PREPARATION FOR THE LAW

Advisers: Professor Stewart and Mr. MacGregor

Business Law	Finance
Constitutional Law	Banking and Currency
International Law	Investments
Economics	Labor Legislation and Administration
Accounting Theory and Practice	Transportation
Corporation Accounting	Psychology
Statistics	

ACCOUNTANCY

Advisers: Professor Stewart and Associate Professor Bickley

Accounting Theory and Practice	Statistics
Corporation Accounting	Finance
Auditing	Banking and Currency
Manufacturing Accounts	Investments
Economics	Industrial Management
Business Law	Transportation
Constitutional Law	

FINANCE, BANKING AND INVESTMENT BUSINESS

Advisers: Professor Stewart and Assistant Professor Curtis

Finance	Business Law
Banking and Currency	Transportation
Investments	Constitutional Law
Statistics	Economic Geography
Economics	Industrial Management
Accounting Theory and Practice	Labor Legislation and Administration
Corporation Accounting	

INDUSTRIAL ADMINISTRATION

Advisers: Professor Stewart and Associate Professor Bickley

Accounting Theory and Practice	Industrial Management
Corporation Accounting	Labor Legislation and Administration
Manufacturing Accounts	Business Law
Economics	Constitutional Law
Industrial History	Transportation
Economic Geography	Statistics
Construction	Finance
Engineering Drawing	Investments
Psychology	Electives from Courses in Engineering and Chemistry

FOREIGN TRADE

Advisers: Professor Stewart and Assistant Professor Curtis

Economic Geography of the Western Hemisphere	Constitutional Law
Economic Geography of the Eastern Hemisphere	Finance
Economics	Banking and Currency
Spanish	Investments
Statistics	Accounting Theory and Practice
Business Law	Corporation Accounting
International Law	

The work of the College covers four years. On its completion the degree of Bachelor of Science in Business Administration is given.

THE COURSE IN BUSINESS ADMINISTRATION

FIRST TERM		FRESHMAN YEAR	SECOND TERM	
English (3)	120, 121	English (3)	122, 125	
Spanish (3)	110 or 111	Spanish (3)	110 or 111	
or Portuguese (3)	114	or Portuguese (3)	114	
Industrial History (3)	38	Industrial History (3)	38	
Plane Trigonometry (3)	141	Solid Geometry (3)	140	
Engineering Drawing (3)	160a	Engineering Drawing (2)	161a	
Construction (1)	162	Construction (1)	163	
Mil. Sci. & Tactics (2)	470	Mil. Sci. & Tactics (2)	470	
Military Drill ($\frac{1}{2}$)	470	Military Drill ($\frac{1}{2}$)	470	
Gymnasium ($\frac{1}{2}$)	500	Gymnasium ($\frac{1}{2}$)	500	
FIRST TERM		SOPHOMORE YEAR	SECOND TERM	
Physiography (2)	277	Physiography (3)	278	
Accounting (3)	20	Accounting (3)	21	
Constitutional Law (3)	33	Constitutional Law (3)	33	
Economics (3)	16	Economics (3)	17	
Economic Geography of North and South America (3)	35	Economic Geography of North and South America (3)	35	
Spanish (3)	111 or 113	Spanish (3)	111 or 113	
or Portuguese (3)	115	or Portuguese (3)	115	
Mil. Sci. & Tactics (2)	471	Mil. Sci. & Tactics (2)	471	
Military Drill ($\frac{1}{2}$)	471	Military Drill ($\frac{1}{2}$)	471	
Physical Education ($\frac{1}{2}$)	500	Physical Education ($\frac{1}{2}$)	500	
FIRST TERM		JUNIOR YEAR	SECOND TERM	
Business Law (2)	31	Business Law (3)	32	
U. S. History (3)	40	U. S. History (3)	40	
Labor Legis. & Adm. (3)	23	Labor Legis. & Adm. (3)	23	
Transportation (2)	22	Transportation (2)	22	
Statistics (3)	26	Corporation Finance (Elect.) (3)	18a	
Corporation Accounting (Elect.) (3)	21	Statistics (3)	26	
Corporation Finance (Elect.) (3)	18a	Economic Geography of the Eastern Hemisphere (3)	36	
Economic Geography of the Eastern Hemisphere (3)	36	Psychology (2)	2	
Psychology (2)	2	Physical Education (1)	500	
Physical Education (1)	500			
FIRST TERM		SENIOR YEAR	SECOND TERM	
Finance (3)	19	Finance (3)	19	
Banking and Currency (3)	27	Banking and Currency (3)	27	
Investments (3)	25	Investments (3)	25	
Auditing (Elect.) (3)	21a	Manufacturing Accounts (Elect.) (3)	21b	
Mod. European History (3)	41	Mod. European History (3)	41	
International Law (3)	34	International Law (3)	34	
Development of Economic Thought (3)	24	Development of Economic Thought (3)	24	
Physical Education (1)	500	Thesis		
		Physical Education (1)	500	

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

Students may, with the approval of the Faculty, substitute for some of the subjects in the Junior and Senior years, other subjects which will better suit their future aims.

Prospective teachers should in this connection read the statement concerning Courses for Teachers.

THE COLLEGE OF ENGINEERING

THE COURSE IN CIVIL ENGINEERING

The requirements for admission to the Course in Civil Engineering are given on page 19.

The purpose of this course is to give a broad education in those general and scientific subjects which form the foundation of all branches of technology and special training in those subjects comprised under the term of Civil Engineering. The department aims to teach young men how to think and how to attack new problems, to impress upon them the underlying principles of engineering and to inspire them with a desire to do their best work.

The Freshman year is devoted mostly to fundamental studies which give both general culture and preparation for the technical work of the following years. Mathematics, physics, modern languages, military science and tactics and chemistry are given throughout both terms. Students continue in the Freshman year the modern foreign language accepted for entrance. Drawing is done throughout the year and the drawing room exercises are supplemented by recitations.

The course in Construction of the Freshman year affords students a general idea of the scope of engineering. In this course are grouped the topics of masonry, foundations of bridges and buildings, types of retaining walls and dams, the history of architecture and engineering, street and highway construction, the history of bridges and the materials of construction. The work covers two terms and is carried on by lectures.

Land and Topographic Surveying is given in the four weeks following the end of the Freshman year. By this arrangement the attention of students is concentrated upon a single subject, thus enabling practical field operations to be exemplified in the best manner. In Railroad Surveying of the Junior year both preliminary and final locations of a line are made and plans, profiles and estimates of cost are prepared. In Geodetic Surveying, given in the Senior year, triangulations of a high degree of precision are executed, also determinations of azimuth and adjustments of the results are made by standard methods. A large collection of levels, transits and other surveying in-

struments enables the students to become familiar with instruments of the best type.

Among other required subjects is Strength of Materials, which presents the theory of beams, columns and shafts, and the methods of computing and designing them. Laboratory tests are made of timber, brick, iron and steel. Strength of Materials as here presented may be described as applied mechanics, that is, the application of mechanics to the design of engineering structures. The testing of materials is of great importance for the student's understanding of the mechanics of engineering and for the capacity it gives him to manipulate apparatus and to handle machines.

Roofs and Bridges receive attention throughout four terms. The analysis of trusses by graphic methods is given in the second term of the Sophomore year. Analytical methods of computing stresses are taken up in Roofs and Bridges of the second term of the Junior year and in Bridge Design and Bridges and Dams of the Senior year. Visits are made to bridges and to bridge shops. In the Senior year designs and working drawings are prepared by each student for both a highway and a railroad bridge. Some of these drawings are made in the same manner as in drawing rooms of bridge companies and others are general, that is, design drawings only. The theory of cantilever, draw, suspension and arch structures receives detailed attention. The design and construction of reinforced concrete are given in the second term of the Senior year in the course in Reinforced Concrete. This extended training in bridge engineering furnishes a foundation for structural steel and reinforced concrete work in practice.

Hydraulic Engineering and Sanitary Engineering are treated at length. The theory of the flow of water through orifices, weirs, pipes and channels together with the principles of hydraulic motors is given in the Junior year, the work being supplemented by testing in the hydraulic laboratory. In the Senior year the subjects of water supply, water and sewerage are discussed. The methods of collecting, purifying and distributing water are explained and compared; house drainage, the design of sewerage systems and the disposal of sewage also receive attention. Computations for dams, standpipes, sewers and other appurtenances are made. Canal engineering,

river and harbor work and land drainage are studied; irrigation by both water and sewage are discussed. This training in Hydraulics and Sanitary Engineering subjects, including Sanitary Biology of the Senior year, is planned to enable a graduate to enter upon the work of city engineering. In connection with the course in hydraulics, measurements are made of the flow in the Lehigh River, the Lehigh Canal and other streams in the vicinity of Bethlehem and the data thus obtained are studied later and reports written thereon. In view of the increasing importance of water power development this work is of value and interest.

Contracts and Specifications of the second term of the Senior year is presented by the Civil Engineering Department more from the engineering than from the legal viewpoint. This course, consisting of two lectures a week, gives the essential features of contracts and the form and scope of contracts and specifications as used in building engineering works.

Ship Construction and Ocean Transportation, required of Seniors in Civil Engineering, includes a brief history of ship development and treats of steel design and construction, especially of the hull which is closely allied to structural design. Lectures are given concerning the planning of harbors and the design and construction of such terminal facilities as piers, dry docks and railroad facilities required at ocean terminals. Ocean trade routes, ship canals and their influence on trade routes, ocean freight rates and terminal charges are some of the phases of foreign commerce treated in this course. •

A description of the Fritz Engineering Laboratory which is operated by the Civil Engineering Department is given in this Register under the heading of Buildings.

The student who completes this course receives the degree of Civil Engineer (C.E.). Mature young men, if properly qualified, may take special studies without being candidates for the degree. Graduates of this course may become candidates for the degree of Master of Science under the regulations stated elsewhere in this Register.

THE COURSE IN CIVIL ENGINEERING

FIRST TERM	FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145
Elementary Chemistry (2)	390	Qualitative Analysis (3)	395
Chemistry Lab. (2)	391	Stoichiometry (1)	397
Elementary Mechanics (3)	320	Elem. Mech. & Heat (3)	321
French (3)	94	Phys. Measurements (1)	322
or Spanish (3) *	111	French (3)	94
or German (3)	75	or Spanish (3)	111
Engineering Drawing (3)	160	or German (3)	75
Construction (1)	162	Engineering Drawing (2)	161
Mil. Sci. & Tactics (2)	470	Construction (1)	163
Military Drill (½)	470	Mil. Sci. & Tactics (2)	470
Gymnasium (½)	500	Military Drill (½)	470
		Gymnasium (½)	500

SUMMER TERM: Land and Topographic Surveying (3), 164.

FIRST TERM	SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)	147
Analytic Geom. (4)	146	Light & Sound (3)	325
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)	326
Mech. & Heat Lab. (1)	324	General Geology (2)	268
Mineralogy (4)	266	Geological Lab. and Field	
English (2)	123, 129	Trips (2)	269
Economics (2)	16	English (2)	124, 133
Stereotomy (3)	165	Astronomy (2)	150
Mil. Sci. & Tactics (2)	471	Graphic Statics (2)	166
Military Drill ($\frac{1}{2}$)	471	Mil. Sci. & Tactics (2)	471
Physical Education ($\frac{1}{2}$)	500	Military Drill ($\frac{1}{2}$)	471
		Physical Education ($\frac{1}{2}$)	500

SUMMER TERM: Shop Work or Engineering Construction (3).

FIRST TERM		JUNIOR YEAR	SECOND TERM	
Strength of Materials (4)	167	Hydraulics (3)		171
Strength of Mat. Lab. (1)	168	Hydraulic Lab. (1)		172
Metallurgy (3)	247-249	Roofs & Bridges (3)		173
Heat Engines (3)	205	Heat Engines (3)		206
Analytic Mechanics (2)	149	Accounting (2)		20
Highway Engineering (2)	170	Railroad Surveying (4)		174
Dynamos and Motors (2)	354	Alternating Currents (2)		375
Dynamo Lab. (1)	355	Dynamo Lab. (1)		356
Physical Education (1)	500	Physical Education (1)		500

SUMMER TERM: Shop Work or Engineering Construction (3).

FIRST TERM	SENIOR YEAR	SECOND TERM	
Bridge Design (2)	175	Bridges & Dams (4)	181
Bridge Design Drawing (4)	176	Sanitary Engineering (3)	182
Hydraulic Engineering (4)	177	Reinforced Concrete (4)	183
Railroads (2)	178	Contracts & Specifications(2)	184
Geodetic Surveying (3)	179	Sanitary Biology (3)	295
or Prac. Astronomy (3)	151	Finance (2)	18
Mill Buildings (2)	180	English (2)	136
Business Law (2)	31	Physical Education (1)	500
Physical Education (1)	500		

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN MECHANICAL ENGINEERING

The requirements for admission to the Course in Mechanical Engineering are given on page 19.

The purpose of this course is to give young men a broad and thorough training in the fundamental subjects which underlie all engineering. The course is developed from the viewpoint that the engineer should be, first, a good, effective citizen, loyal and true to the community, and to the organization which he serves, and after that a professional man not only qualified to render service as an engineer of material, but equipped to cope with and carry forward the ethics of human engineering and leadership.

The Freshman year is given to fundamental studies in preparation for the technical work of the following years and to studies of general cultural value. The former comprise Advanced Algebra, Analytic Geometry, Elementary Chemistry with laboratory exercises, Qualitative Analysis, Stoichiometry, Elementary Mechanics, Heat, laboratory work in Physical Measurements and a course of lectures on Engineering Construction. The general studies are English, Military Science and Tactics, and modern languages,—French, German or Spanish. Students continue the language accepted for entrance.

At the close of the Freshman year a four weeks' course is given in Constructive Elements of Machinery and of Electrical Apparatus. Students may substitute two months of practical work in an industrial establishment if approved by the Department.

In the Sophomore year the following courses are given: Differential Calculus, Solid Analytic Geometry, Integral Calculus, Electricity and Magnetism, Light and Sound, Elementary Mechanics of Materials (Strength of Materials), Mechanical Drawing, Elementary Machine Design, and Steam Engines. The laboratory course covers mechanics, heat, light, electricity and magnetism. English and Military Science and Tactics are continued and courses in Economics and Accounting are given.

A second summer term at the end of the Sophomore year provides a four weeks' course in shop-instruction (Mechanical Technology). Upon approval by the Department, students may substitute two months of practical shop work in industrial establishments.

The courses given in the Junior year are Differential Equations, Analytic Mechanics, Strength of Materials, Machinery of Transmission, Graphic Statics of Mechanisms, Advanced Electricity and Magnetism, Mechanics of Machinery, Hydraulics, Kinematics, Metallurgy, Graphic Statics of Structures and Dynamos and Motors. Courses are given in Engineering Laboratory and Electrical Laboratory; laboratory courses also accompany the study of Strength of Materials and Hydraulics. In addition to the courses named, Business Law is given during the first term.

At the close of the Junior year students are required to spend at least eight weeks on student apprenticeship work, shop work, or engineering construction as approved by the Department. A report is required.

The courses of the Senior year are Technical Thermodynamics, Internal Combustion Engines (Gas Engines), Machine Design, Steam Turbines and a course designated by the general term Mechanical Engineering in which one or two of the following subjects are taken up: plant engineering, refrigeration, aeronautics, marine engines, etc. Along electrical lines the following courses are included: Alternating Currents, Electrical Engineering and Dynamo Laboratory. The work of the mechanical engineering laboratory is continued throughout the year. Courses are presented in Mill Buildings, Industrial Management, Contracts and Specifications, and Finance.

Instruction in Machine Design is given throughout the Sophomore year. There is a thorough drill in projection drawing. Freehand sketches are first made and measurements taken of machine pieces; these sketches are then converted into full-sized drawings. There is then considerable practise in the interpretation of such drawings. This is followed by difficult projections and intersections and exercises in the proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice. In their Senior year the students undertake the calculations, estimates and working drawings involved in the design of simple but complete machines, the general plan of arrangement being given in the form of rough

sketches, photographs or wood cuts. In the second term the Seniors make original designs for simple machinery.

After completing the general course in Physics, students in Mechanical Engineering take courses along electrical lines. The aim is a clear conception of electrical units and a working knowledge of resistance, impedance, reactance, capacity, the magnetism of iron and the magnetic circuit as used in the construction of electrical machinery. Attention is then directed to the theory and calculation of direct current dynamos, to the study of variable and alternating current phenomena and to the theory of the alternating current apparatus. Practical problems show their application. The laboratory work involves tests of resistance, insulation, consumption of energy and efficiency.

The course in Engineering Laboratory begins with the handling and calibration of the instruments and appliances belonging to the experimental side of mechanical engineering. The simpler tests and experiments are taken up next, and there is a gradual progress toward complex operations such as the complete test of a power plant or pumping station, or a full thermodynamic test of the steam engine. The course is, at present, most fully developed in the field of steam engineering, where it embraces steam calorimetry, flow of steam, the testing of steam traps and separators; of injectors, pumps, and the steam turbine; extensive practice with the indicator, engine tests of various sorts and boiler testing.

Due place is given in the course to gas engineering, tests of gas producers, gas engines and oil engines, work with compressed air, tests of hot-air engines, of centrifugal pumps and of various incidental appliances and apparatus. Dynamometer work includes experiments in friction and lubrication and determination of the efficiency of machines. The purpose of this course is to provide a system of well-selected and graded experiments which will illustrate and impress principles, develop the skill and judgment of the student and give training in the idea, method and detail of this sort of work.

In the Senior year one or two trips are made to New York or Philadelphia during which visits of inspection are made to power plants, municipal works, ship yards and a variety of industrial plants located in these cities or vicinity.

Graduates of this course receive the degree of Mechanical Engineer (M.E.).

THE COURSE IN MECHANICAL ENGINEERING

FIRST TERM		FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145	
Elementary Chemistry (2)	390	Qualitative Analysis (3)	395	
Chemistry Lab. (2)	391	Stoichiometry (1)	397	
Elementary Mechanics (3)	320	Elem. Mech. & Heat (3)	321	
French (3)	94	Phys. Measurements (1)	322	
or German (3)	75	French (3)	94	
or Spanish (3)	111	or German (3)	74	
English (2)	120	or Spanish (3)	111	
Construction (1)	162	English (2)	122	
Mil. Sci. & Tactics (2)	470	Construction (1)	163	
Military Drill (½)	470	Mil. Sci. & Tactics (2)	470	
Gymnasium (½)	500	Military Drill (½)	470	
		Gymnasium (½)	500	

SUMMER TERM: Constructive Elements of Machinery and of Electrical Apparatus, 201, 350, or Practical Employment (3).

FIRST TERM		SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)	147	
Analytic Geom. (4)	146	Light and Sound (3)	325	
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)	326	
Mech. & Heat Lab. (1)	324	Steam Engines (4)	204	
Elem. Mech. Materials (1)	169	Elem. Machine Des. (3)	202	
Drawing & El. Mach. Des. (3)	200	French (3)	95	
Boilers (1)	203	or German (3)	78	
French (3)	95	or Spanish (3)	113	
or German (3)	77	Mil. Sci. & Tactics (2)	471	
or Spanish (3)	113	Military Drill ($\frac{1}{2}$)	471	
Economics (2)	16	Physical Education ($\frac{1}{2}$)	500	
Mil. Sci. & Tactics (2)	471	Accounting (2)	20	
Military Drill ($\frac{1}{2}$)	471			
Physical Education ($\frac{1}{2}$)	500			

SUMMER TERM: Mechanical Technology, 208 or Practical Employment (3).

FIRST TERM		JUNIOR YEAR		SECOND TERM	
Differential Equations (1)	148	Mech. of Machinery (2)	221		
Analytic Mechanics (2)	149	Plant Engineering (1)	228		
Strength of Materials (4)	167	Hydraulics (3)	171		
Strength of Mat. Lab. (1)	168	Hydraulic Lab. (1)	172		
Machinery of Trans. (3)	212	Metallurgy (3)	247-249		
Graphic Statics of Mech. (2)	209	Kinematics (4)	215		
Advanced Elec. & Mag. (2)	328	Graphic Statics (2)	166		
Electrical Lab. (1)	329	Electrical Lab. (1)	330		
Engineering Lab. (2)	210	Engineering Lab. (1)	211		
Business Law (2)	31	Dynamos and Motors (2)	354		
Physical Education (1)	500	Physical Education (1)	500		

SUMMER TERM: Student Apprenticeship Work, Shop Work or Engineering Construction (3).

FIRST TERM		SENIOR YEAR	SECOND TERM	
Thermodynamics (4)	214	Steam Turbines (4)	224	
Plant Engineering (1)	228	Mech. Engineering (3)	225	
Gas Engines (3)	223	Plant Engineering (1)	227	
Machine Design (4)	216	Machine Design (4)	220	
Alternating Currents (2)	375	Electrical Engineering (2)	361	
Dynamo Lab. (1)	355	Finance (2)	18	
Engineering Lab. (1)	217	Dynamo Lab. (1)	356	
Mill Buildings (2)	180a	Engineering Lab. (1)	222	
Industrial Management (2)	24	Contracts & Specifications (2)	184	
Physical Education (1)	500	Physical Education (1)	500	

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN METALLURGY

The requirements for admission to the Course in Metallurgy are given on page 19.

This course is designed to prepare the student for practice in any or all directions in the field of metallurgy, such as the extraction of metals from their ores and the working and refining of metals. The two branches of this subject formerly comprised in the separate courses of Metallurgical Engineering and Electrometallurgy have been united, so that the graduate is properly equipped in both of these directions and may properly be designated as prepared in the whole field of metallurgy.

The basis of the course is necessarily fundamental and thorough training in mathematics, chemistry and physics, followed by such advanced chemistry as is useful to the metallurgist. These fundamental studies are not cut or restricted, but are given the full prominence which they should have in a metallurgist's education.

Collateral studies in other departments than metallurgy are liberally provided, such as Mineralogy, Blowpiping, General Geology, Geological Practice and Economic Geology in the Department of Geology; Mechanical Drawing and Ore Dressing in the Department of Mining Engineering; Advanced Electricity and Magnetism and Electrical Laboratory in the Department of Physics; Alternating Currents, Dynamos and Motors, Electric Power Transmission, Electrical Engineering and Dynamo Laboratory in the Department of Electrical Engineering; Elements of Construction of Machinery, Heat Engines, comprising the study of boilers, steam engines, gas engines and internal combustion motors, and Engineering Laboratory, in the Department of Mechanical Engineering; Hydraulics and Strength of Materials, with laboratory testing, in the Department of Civil Engineering.

Instruction in English composition, writing and oratory, in Economics, Business Law, and Contracts and Specifications is included in order to broaden the student's education. The study of German or French for one year is required, the student continuing the language on which he enters; if a student enters on Spanish he takes one year of German. The one year of German or French is supplemented in the Senior year by read-

ings in Metallurgical German or French with the staff of the Department of Metallurgy.

The studies in chemistry, which are so important to the metallurgist, include Laboratory Experiments, Qualitative and Quantitative Analysis, both gravimetric and volumetric, of the more common ores and metallurgical products, including Gas Analysis and Assaying, along with courses in Stoichiometry, Chemical Philosophy, Advanced Chemistry, Physical Chemistry and Physical Chemistry Laboratory. This instruction, together with the course in Physics and Physical Laboratory, constitutes the foundation on which the metallurgical instruction is based.

The special instruction in Metallurgy is begun by introductory courses of lectures on the history of the metals, their economic and mechanical importance, their physical and chemical properties, including statistics of their production and details of the distribution of their ores and the geographical distribution and conditions of their production. In connection with this some visits are taken to near-by metallurgical plants to make the student familiar with the appearance and general outline of metallurgical apparatus. Courses of lectures extending over a year take up in detail the principles of metallurgy in general. They begin with the general physical and chemical principles utilized in extracting metals from their ores, and the manner in which they are applied and are followed by a course of lectures on the Metallurgy of Iron and Steel, and by another course in the Metallurgy of the other metals, in which each metal is discussed in detail. In order to impress these principles upon the student and to render their application familiar, he is required to solve a series of problems dealing with practical details of the metallurgical processes in an exact and quantitative manner, the data being taken from practice and the results being intended to give an insight into the most fundamental metallurgical questions. A course of lectures follows this in the principles of electrochemistry, and their application in electrometallurgy, accompanied by laboratory investigations of these principles as well as the general principles of metallurgical processes, including methods of making physical and chemical measurements which are of value to the practicing metallurgist. A course in Metallography acquaints the student with the methods of studying with the microscope and other

instruments of precision, the physical properties, constitution and structure of metals and alloys. The course in Metallurgical Design covers the principles of designing metallurgical plant and apparatus, involving fixing the sizes and shapes of various parts of metallurgical apparatus. The seminary in the Senior year is intended to bring together the members of the Department and the students in the discussion of current metallurgical questions and problems, and students' theses.

In the summer vacations at the end of the Sophomore and Junior years the student is required, if arrangements can be made, to spend two months in practical work in a metallurgical establishment or such other plant as is approved by the Department.

The proximity of the works of the Bethlehem Steel Company and the kindness of its officers give opportunity for visits of inspection by the students in classes and individually, thus affording unusual facilities for the practical study of the metallurgy of iron and steel. In connection with the metallurgical laboratory work, it is the practice to make investigations of the working efficiencies of furnaces in actual operation. Occasional visits of inspection are made to more distant works, in connection with the metallurgy of zinc, copper, lead, gold and silver.

Graduates of this course receive the degree of Metallurgical Engineer (Met.E.).

THE COURSE IN METALLURGY

FIRST TERM	FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145
Elementary Chemistry (2)	390	Qualitative Analysis (3)	395
Chemistry Lab. (2)	391	Qual. Anal. Conf. (1)	396
Elementary Mechanics (3)	320	Stoichiometry (1)	397
German (3)	75 or 70	Elem. Mech. & Heat (3)	321
or French (3)	94	Phys. Measurements (1)	322
English (2)	120, 121	German (3)	75 or 71
Mechanical Drawing (3)	300	or French (3)	94
Mil. Sci. & Tactics (2)	470	English (2)	122, 125
Military Drill (½)	470	Descriptive Geometry (2)	300
Gymnasium (½)	500	Mil. Sci. & Tactics (2)	470
		Military Drill (½)	470
		Gymnasium (½)	500

SUMMER TERM: Constructive Elements of Machinery and of Electrical Apparatus (3), 201, 350.

FIRST TERM	SOPHOMORE YEAR	SECOND TERM	
Differential Calculus (4)	146	Solid Analytic Geom. & Integral Calculus (4)	147
Quantitative Analysis (3)	401	Quantitative Analysis (3)	403
Quant. Anal. Conf. (1)	402	Quant. Anal. Conf. (1)	405
Chemical Philosophy (3)	398	Advanced Chemistry (3)	399
Elec. & Magnetism (3)	323	Light & Sound (3)	325
Mech. & Heat Lab. (1)	324	Light, Elec. & Mag. Lab. (1)	326
Introductory Met. (1)	242	Hydraulics (3)	171
Economics (2)	16	Introductory Met. (1)	242
Mil. Sci. & Tactics (2)	471	Mil. Sci. & Tactics (2)	471
Military Drill (½)	471	Military Drill (½)	471
Physical Education (½)	500	Physical Education (½)	500

SUMMER TERM: Assaying, 413, Practical Employment (3).

FIRST TERM	JUNIOR YEAR	SECOND TERM	
Physical Chemistry (3)	419	General Metallurgy (2)	244
Physical Chem. Lab. (1)	420	Met. of Iron & Steel (2)	245
Mineralogy (4)	266	Met. Problems (1)	246
Blowpipe Analysis (1)	267	General Geology (2)	268
Ore Dressing & Lab. (3)	302	Geological Lab. and Field Trips (2)	269
Adv. Elec. and Mag. (2)	328	Alternating Currents (2)	375
Electrical Lab. (1)	329	Electrical Eng. (2)	361
Dynamos & Motors (2)	354	Electrical Lab. (1)	330
Heat Engines (3)	205	Dynamo Lab. (1)	355
Physical Education (1)	500	Heat Engines (3)	206
		Blowpipe Analysis (1)	267
		Physical Education (1)	500

SUMMER TERM: Practical Employment (3).

FIRST TERM	SENIOR YEAR	SECOND TERM	
Strength of Materials (4)	167	Electrometallurgy (1)	254
Strength of Mat. Lab. (1)	168	Metallurgical Design (2)	258
Non-ferrous Met. (4)	251	Metallurgical Lab. (2)	256
Met. Problems (1)	252	Met. Seminary (1)	260
Metallography (2)	257	Thesis (3)	261
Electrochemistry (1)	253	Engineering Lab. (1)	218
Electrochem. Lab. (1)	255	Elec. Power Transmission (3)	372
Engineering Lab. (1)	217	Economic Geology (4)	271
Electrical Lab. (1)	331	Contracts & Specifications (2)	184
Business Law (2)	31	Physical Education (1)	500
Met. French or Ger. (1)	259		
Seminary (1)	260		
Physical Education (1)	500		

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN MINING ENGINEERING

The requirements for admission to the Course of Mining Engineering are given on page 19.

The object of this course is primarily to train a student for practice in the field of mining engineering. It is designed to give him the thorough fundamental training of an engineer and a breath of education that will enable him readily to undertake work in the various lines of engineering frequently presented to one of his profession.

The course, therefore, places the graduate in the path of a large number of opportunities. Not only will he have had sufficient practice and training to enter upon the field of mining, but he can pursue work in which geology and metallurgy play an important part, and also in related engineering projects.

In the Freshman year a foundation is laid in the fundamental subjects of mathematics, physics, chemistry, English and modern foreign languages. The modern language pursued is the one presented for entrance. Lectures are given in physiology and hygiene, also in military science and tactics. Military drill and systematic physical exercise are required.

The course in Drawing begins as soon as the student enters the University. He learns the use of drawing instruments, makes tracings and blue prints, drawings of machine parts of simple construction, and solves problems in Descriptive Geometry. Lectures on Construction are given to show the general scope of engineering.

The summer schools in Land and Topographic Surveying and in Mine and Railroad Surveying are held at the close of the Freshman and Junior years respectively. The second of these schools is conducted partly in the mining regions; this gives practice in mine and railroad surveying and permits a study of mining operation and mining plants, from which data are secured exemplifying class room work and facilitating the course in Mining Design of the Senior year.

The courses in Chemistry extend from the first term of the Freshman year to the summer school in Assaying at the end of the Sophomore year. Beginning with an introduction to general chemical theory and the elements, supplemented by laboratory

work, the subject is continued by Qualitative and Quantitative Analysis. Chemical problems and reactions are taught in Stoichiometry. The instruction includes the analysis of common ores, fuels, gases and metallurgical products.

Courses in Business Law, Finance, Industrial Management, Contracts and Specifications, extending over the two upper years, present to the student the several economic, commercial, administrative and legal aspects of conditions existing in the industrial world which are of particular concern to the engineering profession.

The importance of the conservation of the timber resources of the country and the preservation of wood against decay are treated in Forestry, together with the characteristics of the woods of the important timber species. The course in Biology takes up the study of living organisms, their structure, development, origin and distribution.

Mineralogy is introduced by a short course in Crystallography, in which models of crystals and mineral specimens are studied. The various means of identification are then applied to more difficult minerals, the determination of which may be assisted and effected by the work in Blowpipe Analysis.

In the courses in Geology, the student studies the forms and structures of the rock masses of the earth's crust, and the forces which modify them. A brief review of historical geology deals with the fossil life of the globe. Practice in Field Geology teaches the methods by which rock formations are accurately mapped. Economic Geology treats of the origin, mode of occurrence and distribution of the metallic and non-metallic minerals and substances of commercial value in the earth. The course in Petrography enables the student to identify the common rock-forming minerals by the use of the microscope, especially when the constituents are too fine-grained to be determined by the eye alone. Practice in the petrographic and geological laboratory and in the field qualifies the student to recognize the main types of rocks.

Physiography treats of the classification of land forms and their geographical distribution, their relation to geologic structure, weather and climate, and their influence upon the economic development of countries. The course in Geology of North America discusses the geologic ages and the geographic

distribution of the rocks of the continent, their structure and history, and includes studies of the great surveys that have been made. Paleontology reviews the life of past ages and involves the study and identification of fossils as a means of determining the age of rocks by the principles of stratigraphy.

The course in Heat Engines includes a practical study of boilers, steam and gas engines and steam turbines; work in the Wilbur Engineering Laboratory includes tests and calculations of efficiencies and powers under varying conditions.

Strength of Materials treats of the theories which govern the strength of all kinds of common materials used in construction. Practice is given in computing and designing beams, columns, girders, etc. Hydraulics deals with the flow of liquids through orifices, mains, pipes and channels, and with the principles of hydraulic motors; practical work in the Fritz Engineering Laboratory is a part of this course. Graphic Statics qualifies the student to compute the forces developed in roof trusses, beams and girders by the methods of graphical analysis.

The instruction in Mining Engineering is given during the Junior and Senior years, under the following subdivisions: prospecting, boring, mining or exploitation, haulage, hoisting, drainage, ventilation, lighting, first-aid, railroads, construction materials and mine administration. These subjects treat successively of the steps by which minerals are discovered and valued, the manner in which they are extracted from the earth and brought to the surface, the means by which mines are maintained in an economical condition from the viewpoint of mine owner and miner, the manner in which accidents may occur and means for guarding against them, and the treatment of injured persons.

The subject of Ore Dressing, supplemented by work in the Coxe Mining Laboratory, deals with the processes by which ores and fuels, direct from the mine, are rendered marketable. Construction Materials treats of the materials used in roads and structures in and around mines. Mine Administration discusses the method of employing labor and of keeping accounts, mining principles and management.

The course in Oil and Gas Technology includes a study of the occurrence and distribution of petroleum and natural gas, the

methods of prospecting, the means for obtaining them from the earth, and their storage and transportation.

In Mining Design the student employs principles studied and observations made as the basis for designs and working drawings of parts of mining plant to fulfill given conditions.

In Metallurgy the general principles of the subject embracing fuels, furnaces and processes, are presented, followed by the metallurgy of iron and steel, copper, lead, gold, silver, zinc, tin, mercury, nickel and aluminium. Electrometallurgy familiarizes the student with the practical applications of electricity to metallurgical processes including electric-furnace practice.

Dynamos and Motors and Alternating Currents extend over the entire Senior year and embrace the study of the industrial applications of electricity which are of particular value to the mining engineer; practical work in the Dynamo Laboratory is included in these courses.

It may thus be observed that the student of the Course in Mining Engineering has studies in all of the technical departments of the University, as well as in many of the arts and science departments.

The facilities for exemplifying the work of the course are exceptional. Cement mills, cement, slate and other quarries, ore and coal mines are within easy distance, and in the city are the great works of the Bethlehem Steel Company. During the Junior and Senior years all students in Mining Engineering are required to make inspection trips to the anthracite coal regions and to the metal mining districts of eastern Pennsylvania and of New Jersey and to the metallurgical works of those districts.

The Department of Mining Engineering has exceptional facilities in the Eckley B. Coxe Mining Laboratory. A description of the Laboratory is given on pages 155-156 of this Register.

Graduates of this course receive the degree of Engineer of Mines (E.M.).

THE COURSE IN MINING ENGINEERING

FIRST TERM	FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145
Elementary Chemistry (2)	390	Qualitative Analysis (3)	395
Chemistry Lab. (2)	391	Stoichiometry (1)	397
Elementary Mechanics (3)	320	Elem. Mech. & Heat (3)	321
Spanish (3)	111	Phys. Measurements (1)	322
or French (3)	94	Spanish (3)	111
or German (3)	75	or French (3)	94
English (2)	120	or German (3)	75
Mechanical Drawing (2)	300	English (2)	122
Construction (1)	162	Construction (1)	162
Mil. Sci. & Tactics (2)	470	Descriptive Geom. (2)	300
Military Drill (½)	470	Mil. Sci. & Tactics (2)	470
Gymnasium (½)	500	Military Drill (½)	470
		Gymnasium (½)	500

SUMMER TERM: Land and Topographic Surveying (3), 164.

FIRST TERM	SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)	147
Analytic Geom. (4)	146	Quantitative Analysis (3)	403
Quantitative Analysis (3)	401	Quant. Anal. Conf. (1)	405
Quant. Anal. Conf. (1)	402	Light & Sound (3)	325
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)	326
Mech. & Heat Lab. (1)	324	General Geology (2)	268
Mineralogy (4)	266	Geol. Lab. & Field Trips (3)	269
Blowpipe Analysis (1)	267	Blowpipe Analysis (1)	267
Economics (2)	16	Mil. Sci. & Tactics (2)	471
Mil. Sci. & Tactics (2)	471	Military Drill (½)	471
Military Drill (½)	471	Physical Education (½)	500
Physical Education (½)	500		

SUMMER TERM: Assaying (3), 413.

FIRST TERM	JUNIOR YEAR	SECOND TERM	
Mining (4)	301	Mining (4)	303
Ore Dressing & Lab. (3)	302	General Metallurgy (2)	244
Strength of Materials (4)	167	Met. of Iron & Steel (2)	245
Heat Engines (3)	205	Met. Problems (1)	246
Petrography (2)	276	Heat Engines (3)	206
Graphic Statics (2)	166	Hydraulics (3)	171
Business Law (2)	31	Hydraulic Lab. (1)	172
Physical Education (1)	500	Physiography (2)	274
		Finance (2)	18
		Physical Education (1)	500

SUMMER TERM: Mine and Railroad Surveying (3), 304.

FIRST TERM	SENIOR YEAR	SECOND TERM	
Mining (3)	305	Mining Design (3)	307
Economic Geology (2)	270	Economic Geology (4)	271
Non-ferrous Met. (3)	251	Electrometallurgy (1)	254
Dynamos & Motors (2)	354	Alternating Currents (2)	375
Dynamo Lab. (1)	355	Dynamo Lab. (1)	356
Field Geology (3)	275	Geology of N. America (3)	273
Forestry (3)	291	or Paleontology (3)	272
or Biology (3)	292	Oil & Gas Tech. (2)	306
Industrial Management (2)	24	Contracts & Specifications (2)	184
Engineering Lab. (1)	218	Engineering Lab. (1)	219
Physical Education (1)	500	Physical Education (1)	500

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN ELECTRICAL ENGINEERING

The requirements for admission to the Course in Electrical Engineering are given on page 19.

The object of this course is to give a broad education in those general and scientific subjects which underlie all the branches of engineering, and to give special training in those technical and business subjects which experience shows are most essential in the equipment of the electrical engineer. In seeking to accomplish this object the Department puts chief emphasis upon mastery of principles and thoroughness in the analysis of problems.

The course includes a number of special studies in civil, mechanical and metallurgical engineering, so that the graduate in Electrical Engineering is prepared not only to enter any of the branches of electrical engineering but also to deal with related problems in the other branches of engineering. The electrical engineering graduate of today finds that professional advancement often lies through commercial, managerial or executive channels. As superintendent or manager of electric light, power or railway properties he must be prepared to handle problems involving not merely material and technical details but human relations, touching workmen, capitalists, public utility commissioners, and the public. He must know something of the principles of accounting, economics, business law and industrial management. A number of such studies have been introduced into the course.

The fundamental studies are given in the early part of the course and include mathematics, physics, chemistry, English and that modern language accepted for entrance. These subjects include the more essential features of a broad education and they furnish a preparation for the more advanced scientific and technical training to follow. At the very outset the student, through the subject Construction, imbibes the spirit of engineering. He is taught its history, development, methods and scope.

Work in applied electricity, begun during the summer term at the end of the Freshman year, is continued through the Sophomore year in the study of Electric Distribution, and

Dynamos and Motors, with Dynamo Laboratory. The Junior and Senior years are devoted almost exclusively to advanced technical work.

The study of Electricity and Magnetism constitutes an introduction to the industrial applications of electricity. Electric Distribution makes immediate application of electrical theory to the calculation of lighting and power circuits, the testing of insulation resistance and similar problems. The study also includes the installation and wiring of electrical machinery, systems of electrical distribution, outside and interior wiring.

The study of Dynamos and Motors includes the construction, operation and control of direct current generators and motors, with numerous illustrative problems. The study of dynamo electric machinery is resumed during the Senior year in connection with the subjects Electrical Design and Alternating Current Machinery.

Fundamental subjects in mechanical engineering are required in this course. Machine Design is given throughout the Sophomore year. Constructive Elements of Machinery is given in the summer term at the end of the Freshman year in conjunction with the work in Constructive Elements of Electrical Apparatus. Mechanical Technology is given in the summer term at the end of the Sophomore year. Frequent visits of inspection are made to manufacturing establishments in the vicinity. Upon approval by the Head of the Department, students in Electrical Engineering will be permitted to substitute summer work in electrical shops or construction for either or both of the required summer schools. Following the work in Mechanical Technology comes the study of Graphic Statics of Mechanisms. It deals with graphic methods of determining the forces acting at all points of a machine and with the efficiency of mechanisms. Heat Engines includes the study of steam boilers, thermodynamics, steam engines and turbines, and gas engines. Engineering Laboratory is given throughout the Senior year.

Important studies in Civil Engineering are included in this course. Strength of Materials is concerned with the theory of beams, columns and shafts, and the method of computing and designing them; the subject includes practical work in the testing laboratory. Hydraulics, including laboratory practice,

treats of hydrostatics and theoretical hydraulics, the flow of water through orifices, weirs, pipes and channels, naval hydro-mechanics and hydraulic motors.

The study of General Metallurgy, Metallurgy of Iron and Steel and Metallurgical Problems is given during the second term of the Junior year. Lectures on Electrochemistry and Electrometallurgy are given during the Senior year.

Advanced studies in Electrical Engineering follow Electric Distribution, Dynamos and Motors, and Electricity and Magnetism of the Sophomore year. Advanced Theory of Electricity and Magnetism is devoted to the theory of electrical units and measurements, ferromagnetism, electromagnetism, and advanced theory of electrostatics and electric oscillations and waves, electron theory and electrolysis. The accompanying laboratory work is devoted to precise electrical measurements and the standardization and calibration of electrical measuring instruments. The Theory of Alternating Currents deals with the problems and methods of measurements which are peculiar to the modern practical applications of alternating currents and with the theory underlying the action of the important types of alternating current machinery and transmission lines. Alternating Current Machinery includes the study of the construction and operation of alternating current generators, motors, transformers and other apparatus.

The subject of Electrical Engineering deals with the application of physical principles to the solution of problems relating to direct and alternating current circuits and apparatus.

Dynamo laboratory work, beginning in the second term of the Sophomore year, is continued for five terms. Instruction is based on a laboratory manual or notes supplemented by individual direction and supervision in the laboratory. The students work individually or in pairs, and make the more important tests on direct and alternating current generators and motors, rotary converters, transformers and other electrical apparatus. Written reports of all tests made, with curves plotted from the observations and discussion of results, are required.

Electrical Design, begun in the first term of the Senior year, is pursued throughout the year. It includes the application of electric, magnetic and mechanical principles to the design of

various types of electrical apparatus. The instruction is given by recitations, problems and drafting.

Electrical Engineering Seminary continues throughout the Senior year. The work consists of the presentation before the class of papers on assigned topics, supplementing the regular work of the class-room and of reports on thesis work. The Department reading-room is well supplied with the leading electrical periodicals, American and foreign. One of the principal objects of the Seminary work is to encourage the systematic reading of the current engineering journals.

Dynamo Testing, given by lectures and problems, treats of standard and special methods of making tests on dynamo machines, transformers and other electrical apparatus.

Electric Stations takes up the location, design and equipment of stations, the selection of suitable prime movers, generators, switchboards and other apparatus. The use and operation of storage batteries, boosters and other auxiliaries receive consideration. Under Electric Traction are studied the construction, equipment and operation of different types of electric railways. The recent developments in the application of electric motive power to steam railroad conditions are discussed and the results of tests are analyzed.

The subject of Electric Power Transmission deals with the various elements constituting a transmission system. It includes a study of the generating plant, the transmission line and the receiving systems. Special attention is given to the design, construction and protection of the line. Under the last three subjects are included visits of inspection to electric light and power stations and manufacturing establishments in Bethlehem and elsewhere. Central station tests are made and reports are required.

Graduates of this course receive the degree of Electrical Engineer (E.E.).

THE COURSE IN ELECTRICAL ENGINEERING

FIRST TERM		FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145	
Elementary Chemistry (2)	390	Qualitative Analysis (3)	395	
Chemistry Lab. (2)	391	Stoichiometry (1)	397	
Elementary Mechanics (3)	320	Elem. Mech. & Heat (3)	321	
French (3)	94	Phys. Measurements (1)	322	
or German (3)	75	French (3)	94	
or Spanish (3)	111	or German (3)	75	
English (2)	120, 121	or Spanish (3)	111	
Construction (1)	162	English (2)	122, 125	
Mil. Sci. & Tactics (2)	470	Construction (1)	163	
Military Drill (½)	470	Mil. Sci. & Tactics (2)	470	
Gymnasium (½)	500	Military Drill (½)	470	
		Gymnasium (½)	500	

SUMMER TERM: Constructive Elements of Machinery and of Electrical Apparatus, 201, 350, or Electrical Shops (3).

FIRST TERM	SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)	147
Analytic Geom. (4)	146	Light & Sound (3)	325
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)	326
Mech. & Heat Lab. (1)	324	Dynamos and Motors (3)	352
Elem. Mech. Materials (1)	169	Dynamo Lab. (1)	353
Elec. Distribution (2)	351	Machine Design (3)	202
Drawing & El. Mach. Des. (3)	200	Accounting (2)	20
English (2)	123, 129	Mil. Sci. & Tactics (2)	471
Economics (2)	16	Military Drill (½)	471
Mil. Sci. & Tactics (2)	471	Physical Education (½)	500
Military Drill (½)	471		
Physical Education (½)	500		

SUMMER TERM: Mechanical Technology, 207 or Electrical Shops (3).

FIRST TERM		JUNIOR YEAR	SECOND TERM	
Advanced Elec. & Mag. (2)	328	Alternating Currents (2)	359	
Analytic Mechanics (2)	149	Electrical Engineering (2)	360	
Differential Equations (1)	148	Dynamo Testing (1)	364	
Theory of Alt. Cur. (3)	357	Dynamo Lab. (1)	362	
Dynamo Lab. (1)	358	Electrical Lab. (1)	330	
Electrical Lab. (1)	329	Heat Engines (3)	206	
Heat Engines (3)	205	Hydraulics (3)	171	
Strength of Materials (4)	167	Hydraulic Lab. (1)	172	
Strength of Mat. Lab. (1)	168	Finance (2)	18	
Business Law (2)	31	Metallurgy (3)	247-249	
Physical Education (1)	500	Physical Education (1)	500	

SUMMER TERM: Electrical Engineering Inspection, 376;
Electrical Shops (3).

FIRST TERM	SENIOR YEAR	SECOND TERM	
Alt. Current Machinery (4)	363	Electric Traction (3)	371
Dynamo Lab. (3)	366	Dynamo Lab. (2)	374
Dynamo Testing (1)	365	Elec. Power Trans. (3)	372
Electrical Design (3)	367	Electrical Design (2)	370
Electrical Seminary (1)	369	Electrical Seminary (1)	373
Electric Stations (2)	368	Electrometallurgy (1)	254
Electrochemistry (1)	253	Engineering Lab. (1)	218
Engineering Lab. (1)	217	Contracts & Specifications (2)	184
Industrial Management (2)	24	Thesis (3)	377
Physical Education (1)	500	or Elec. Communication (3)	378
		Physical Education (1)	500

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN CHEMISTRY

The requirements for admission to the Course in Chemistry are given on page 19.

This course, leading to the degree of Bachelor of Science in Chemistry, offers an education primarily in chemistry, with some training in related sciences. The modern conception of an education in chemistry includes a simultaneous, thorough study of physics and mathematics. In addition to these so-called physical sciences, other studies, planned to develop and aid the thought-processes and culture of the student, are embodied in the course. Aside from preparation for the life of a professional chemist, it is well adapted for teachers of chemistry and as a course preliminary to the study of medicine.

This course and the Course in Chemical Engineering are both given under the direction of the Department of Chemistry, and facility is offered for changing from either course to the other at the end of either term of the Freshman year. The entrance subjects required are the same in both courses (see page 19), and the tuition and laboratory costs are practically the same. Subjects with the same title in the tabulated curricula (see pages 66 and 71) are given to students in both courses simultaneously and under the same teachers, and are equal in content. Details of chemistry subjects are described in the course in Chemical Engineering.

French and German receive considerably more attention in the course in Chemistry, both as language tools for the working chemist and in their cultural aspects. Students who enter the University on French continue French through the Freshman year, and take up German through the Sophomore and Junior years. Those who offer German as an entrance subject continue German through the Freshman and Sophomore years and study French through the Junior year. Students who offer Spanish for entrance take German through the Freshman and Sophomore years, and French through the Junior year.

Biology is placed in the Senior year and is taught in the Biology Department of the University. Its value in establishing clear ideas of plant and animal organisms, their functions and interrelations, is of importance to the scientist in chem-

istry; and, furthermore, the laws and theories of biology are of great moment in current intellectual and civic life. This subject is presented in lectures supplemented by work in the laboratory on higher and lower organisms. The course in Bacteriology of the Senior year is given in the same department.

Mineralogy, in the first term of the Junior year, develops the physical and chemical characteristics of minerals, and their recognition in specimens. The study of crystallography is included. Geology follows in the second term of this year.

Economics throughout the Junior year and Modern European History through the Senior year are given by the Department of History and Economics. The same department supervises the Summer Reading in Economics, embracing such subjects as origins of industry and their relations to science, the economic import of inventions, industrial management, business law and custom and contracts. The topics for Summer Reading are also correlated in the lectures under the heading Economics, mentioned above. It is believed that this course of reading and study under expert guidance will inculcate an appreciation of the profit and pleasure to be derived from a continued interest in history and economics.

In order to acquaint the student with factory methods and personnel, a required summer term of work in factory or laboratory is set for the vacations following the Freshman and Junior years. Young men of exceptional ability and ambition are encouraged to enroll in subjects given in the University not listed in the Course in Chemistry, subject to Faculty rules.

The foregoing course will serve as an excellent preparation for graduate study; students who desire to go forward to the Master's Degree (M.S.) will find information on page 135 of this Register.

THE COURSE IN CHEMISTRY

FIRST TERM		FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145	
Elementary Chemistry (2)	390	Chemistry (1)	394	
Chemistry Lab. (2)	391	Qualitative Analysis (3)	395	
Elementary Mechanics (3)	320	Qual. Anal. Conf. (1)	396	
Dr. & El. Mach. Des. (3)	200	Stoichiometry (1)	397	
French (3)	94	Elem. Mech. & Heat (3)	321	
or German (3)	76 or 72	Phys. Measurements (1)	322	
English (2)	120	French (3)	94	
Mil. Sci. & Tactics (2)	470	or German (3)	76 or 72	
Military Drill ($\frac{1}{2}$)	470	English (2)	122	
Gymnasium ($\frac{1}{2}$)	500	Mil. Sci. & Tactics (2)	470	
		Military Drill ($\frac{1}{2}$)	470	
		Gymnasium ($\frac{1}{2}$)	500	

SUMMER TERM: Work in Industrial Shop or Laboratory (3). Summer Reading in Economics (1), 30.

FIRST TERM		SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)	147	
Analytic Geom. (4)	146	Advanced Chemistry (3)	399	
Chemical Philosophy (3)	398	Quantitative Analysis (3)	404	
Quantitative Analysis (3)	400	Quant. Anal. Conf. (2)	405	
Quant. Anal. Conf. (1)	402	Light & Sound (3)	325	
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)	326	
Mech. & Heat Lab. (1)	324	German (3)	79 or 76 or 72	
German (3)	78 or 76 or 72	Mil. Sci. & Tactics (2)	471	
English (2)	123	Military Drill ($\frac{1}{2}$)	471	
Mil. Sci. & Tactics (2)	471	Physical Education ($\frac{1}{2}$)	500	
Military Drill ($\frac{1}{2}$)	471			
Physical Education ($\frac{1}{2}$)	500			

SUMMER TERM: Assaying (3), 413. Summer Reading in Economics (1), 30.

FIRST TERM		JUNIOR YEAR	SECOND TERM	
Quantitative Analysis (2)	406	Organic Chemistry (4)	410	
Quant. Anal. Conf. (2)	407	Organic Chem. Lab. (4)	411	
Organic Chemistry (3)	408	General Metallurgy (2)	244	
Organic Chem. Lab. (2)	409	Met. of Iron & Steel (2)	245	
Mineralogy (4)	266	Met. Problems (1)	246	
Economics (3)	16	General Geology (2)	268	
French (3)	90	Economics (3)	17	
or German (3)	75	French (3)	90	
Physical Education (1)	500	or German (3)	75	
		Physical Education (1)	500	

SUMMER TERMS Work in Industrial Shop or Laboratory (3). Summer Reading in Economics (1), 30.

FIRST TERM		SENIOR YEAR	SECOND TERM	
Physical Chemistry (3)	419	Physical Chemistry (2)	421	
Physical Chem. Lab. (1)	420	Physical Chem. Lab. (1)	422	
Industrial Chem. Lab. (3)	412	Research Chem. Lab. (2)	423	
Non-ferrous Met. (4)	251	Industrial Analysis (3)	416	
Met. Problems (1)	252	Industrial Anal. Conf. (1)	417	
Biology (3)	292	Sanitary Chem. Lab. (2)	418	
Bacteriology (2)	296	History of Chemistry (1)	424	
History (3)	41	History (3)	41	
Physical Education (1)	500	English (2)	136	
		Physical Education (1)	500	

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN CHEMICAL ENGINEERING

The requirements for admission to the Course in Chemical Engineering are given on page 19.

This course of study is designed to prepare the student for the profession of chemical engineering in the construction, control and management of manufacturing establishments which utilize principles of chemistry and its allied arts. Aside from the primary requirement of chemistry, the modern development of the chemical engineer enforces a thorough knowledge of physics and mathematics, together with sound understanding of such fundamentals in mechanical and electrical engineering as will make him a discriminating research and operating engineer.

Elementary Chemistry, begun in the Freshman year, in lectures with demonstrations, text-books and recitations, is supplemented by experiments in the laboratory which develop manipulative skill and make careful observation habitual. An alternate course, less elementary in both class-room and laboratory, is given to entering students who have had a considerable training in elementary chemistry. (See page 27.)

After this preliminary view of the elements of chemistry, there is developed that deeper insight into the changes of matter which is the particular province of general chemistry. In Chemical Philosophy of the Sophomore year particular attention is paid to the theories and modern concepts of chemistry, including solution, equilibrium and energy relations of molecules and of atoms, radio-activity, etc.,—a kind of junior physical-chemistry of the greatest, everyday importance in chemical engineering. This study is continued as Advanced Chemistry, covering a moderately advanced study of chemical substances, their preparation and properties, together with elementary consideration of phase rule and of such general applications as the relations underlying desirable properties in alloys, iron and steel, etc.

Organic Chemistry, taught during the entire Junior year, familiarizes the student with the simpler compounds of carbon, and acquaints him with the usefulness of this branch of chemistry in science, in the chemistry of animal and plant life, and in the manufacture of such chemical products as dyes, drugs and medicines, oils, fats, waxes, and many others.

Introduction to the chemical analysis of substances is begun through Qualitative Analysis in the second term of the Freshman year. This is a laboratory course, proceeding from the recognition of individual substances to the analysis of more complex solutions and solids. Lectures and recitations elucidate the facts and theories underlying analytical chemistry. The simpler mathematical relations of chemical processes are reviewed under Stoichiometry and are illustrated through many problems solved by the student. Quantitative Chemical Analysis by gravimetric, volumetric and electrolytic methods follows through the Sophomore year and the first term of the Junior year, and takes up the analysis of ores, fuels, metallurgical products, commercial chemicals and by-products. Frequent class-room conferences accompany the laboratory work and educate the calculations involved and the scientific foundations of quantitative analysis. The analysis of industrial organic substances and of food-stuffs, drinking and boiler waters is placed in the final term of the Senior year, when the student has a better foundation in increasing experience and a broader outlook toward the important significance of Industrial Chemistry. At this stage, too, is placed the sampling and analysis of illuminating and heating gas, flue gases and other special gases.

Fire-assaying of ores and of gold and silver bullion is taught in the summer term after the Sophomore year when continuous attention throughout the day can be given to muffles and furnaces. The practice in Assaying is accompanied by extensive consideration of the calculations and theories involved in the production of mixtures favorable for the work in hand. A course in Industrial Mineralogy is a part of this summer work, and leads to familiarity with about seventy-five minerals of commercial importance. These minerals are studied in their crystalline forms, also in the forms in which they often present themselves for final utilization by the chemical engineer.

The laboratory methods of Physical Chemistry and the systematic, deeper study of generalizations of chemistry learned in the Sophomore year are reserved for the Senior year under Physical Chemistry. Interrelations of the fundamentals of matter and energy are developed under such cognate headings as two-phase and multiphase systems, thermodynamics, gas reactions, mass action, electrochemistry, colloid chemistry, etc. Attention is given to the usefulness of Physical Chemistry

in the solution of manufacturing problems in Chemical Engineering.

Intensive instruction in the application of factory methods in Chemical Engineering is likewise placed in the Senior year and is grouped under Industrial Chemical Laboratory and Industrial Chemistry. The processes reviewed are varied; such as transportation of gases, liquids and solids; grinding, pulverizing; mechanical, hydraulic and pneumatic separation; evaporation; distillation; filter pressing; centrifuging; autoclaving. Characteristics and adaptability of engineering materials used in apparatus and machines receive full discussion. Selected industries are investigated and explained. Familiarity with manufacture in its scientific and economic aspects is promoted in the special laboratory fitted with industrial apparatus, the student finally submitting full working specifications for a plant designed for the preparation of some industrial product, together with estimates of cost of raw materials and cost of conversion into finished product. Lehigh University is fortunately situated in a district abounding in business enterprises which involve chemical engineering and visits are made to these plants and to factories in the nearby cities of Philadelphia and New York.

In Research Chemical Laboratory of the last term in the Senior year every student is required to solve a novel problem having a scientific basis and is expected to demonstrate some ability as an independent research worker. A short course in History of Chemistry, with individual reading of significant records, co-ordinates the past progress of the science and leads to a nobler pride and an enhanced initiative in the profession which the graduate enters.

Metallurgy and related subjects are taken in the Department of Metallurgy. Instruction in mechanical engineering, so important to the chemical engineer, is given by the Mechanical Engineering Department. Mechanical drawing and the laying out of machine elements in the Sophomore year are followed in the Senior year by the calculations for, and design of some such pieces of machinery as jaw crushers and stirrer autoclaves. In the interim Mechanical Engineering is developed in Steam and Gas Engines of the Sophomore year, in the Engineering Laboratory of the Junior and Senior years and in the Engineering Laboratory of the summer term following the Junior year. A first acquaintance with Constructive Elements

of Machinery and of Electrical Apparatus is acquired in the summer term following the Freshman year. An elementary course in the Mechanics of Materials accompanies the instruction of the first term of the Sophomore year. Many of the problems and innovations of Chemical Engineering demand a more intimate knowledge of the principles and practice of Electrical Engineering than is given in the general course in Physics; this is provided for in the Junior year under Advanced Electricity and Magnetism of the Department of Physics, and under Dynamos and Motors and Alternating Currents, with their laboratory adjuncts, of the Department of Electrical Engineering. A comprehension of the scope and general methods of Geology and Bacteriology is attained in short courses in these subjects. Bacteriology is a lecture and laboratory course, and a working knowledge of bacteriological methods as applied to water and some industrial products is achieved.

In addition to the usual courses in English of the beginning years, a course in English is provided for the Senior year, by which time, it is hoped, the student will have a mature appreciation of literary values. The study of German, a necessary tool in current chemistry, is carried by all students in the Freshman year, and provision is made for needful knowledge of French. Students who present German or Spanish for entrance take French in the Senior year, and those who present French for entrance take additional German in the Senior year.

An approach to the affairs of men and the problems of business and civilization is carried in some period of all four years, and is under the direction of the Head of the College of Business Administration. The full course of lectures in Economics as given in the University is placed in the Junior year. Related reading is specified as summer work, and examination in this requirement is held on the first Saturday following the opening of the first term. Summer reading comprises such matter as origins of industry and their relation to science, industrial management, business law and custom and contracts.

A scientific society is attached to the Department, with a membership of teachers and students, for the presentation of papers, discussion of current journals, and the entertainment of speakers of note in the profession of chemical engineering.

The degree granted on completion of the course is Chemical Engineer (Ch.E.).

THE COURSE IN CHEMICAL ENGINEERING

FIRST TERM		FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145	
Elementary Chemistry (2)	390	Chemistry (1)	394	
Chemistry Lab. (2)	391	Qualitative Analysis (3)	395	
Elementary Mechanics (3)	320	Qual. Anal. Conf. (1)	396	
Dr. & El. Mach. Des. (3)	200	Stoichiometry (1)	397	
German (3)	72 or 76	Elem. Mech. & Heat (3)	321	
English (2)	120	Phys. Measurements (1)	322	
Mil. Sci. & Tactics (2)	470	Elem. Mech. Materials (1)	169	
Military Drill (½)	470	German (3)	72 or 76	
Gymnasium (½)	500	English (2)	122	
		Mil. Sci. & Tactics (2)	470	
		Military Drill (½)	470	
		Gymnasium (½)	500	

SUMMER TERM: Con. Elements of Mach. and of Elec. Apparatus, 201, 350, or industrial work (3). Summer Reading in Economics (1), 30.

FIRST TERM		SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)		147
Analytic Geom. (4)	146	Advanced Chemistry (3)		399
Chemical Philosophy (3)	398	Quantitative Analysis (3)		404
Quantitative Analysis (3)	400	Quant. Anal. Conf. (2)		405
Quant. Anal. Conf. (1)	402	Light & Sound (3)		325
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)		326
Mech. & Heat Lab. (1)	324	Steam & Gas Engines (4)		207
Machine Design (2)	202	Mil. Sci. & Tactics (2)		471
English (2)	123	Military Drill (½)		471
Mil. Sci. & Tactics (2)	471	Physical Education (½)		500
Military Drill (½)	471			
Physical Education (½)	500			

SUMMER TERM: Assaying, 413, and Industrial Mineralogy (3), 414.
Summer Reading in Economics (1), 30.

FIRST TERM		JUNIOR YEAR	SECOND TERM	
Quantitative Analysis (2)	406	Organic Chemistry (4)	410	
Quant. Anal. Conf. (2)	407	Organic Chem. Lab. (4)	411	
Organic Chemistry (3)	408	General Metallurgy (2)	244	
Organic Chem. Lab. (2)	409	Metallurgy of Iron (2)	245	
Advanced Elec. & Mag. (2)	328	Met. Problems (1)	246	
Dynamos & Motors (2)	354	Alternating Currents (2)	375	
Dynamo Lab. (1)	355	Dynamo Lab. (1)	356	
Engineering Lab. (2)	210	General Geology (2)	268	
Economics (3)	16	Economics (3)	17	
Physical Education (1)	500	Physical Education (1)	500	

SUMMER TERM: Engineering Laboratory (3), 212. Summer Reading in Economics (1), 30.

FIRST TERM		SENIOR YEAR	SECOND TERM	
Physical Chemistry (3)	419	Physical Chemistry (2)	421	
Physical Chem. Lab. (1)	420	Physical Chem. Lab. (1)	422	
Industrial Chem. Lab. (3)	412	Industrial Chemistry (3)	415	
Non-ferrous Met. (4)	251	Research Chem. Lab. (2)	423	
Met. Problems (1)	252	Industrial Analysis (3)	416	
Engineering Lab. (1)	216	Industrial Anal. Conf. (1)	417	
Bacteriology (2)	296	Sanitary Chem. Lab. (2)	418	
Electrochemistry (1)	253	Electrometallurgy (1)	254	
Electrochemical Lab. (1)	255	History of Chemistry (1)	424	
Machine Design (2)	209	French (3)	105	
Physical Education (1)	500	or German (3)	73	
		English (2)	136	
		Physical Education (1)	500	

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

THE COURSE IN SHIP CONSTRUCTION AND MARINE TRANSPORTATION

The requirements for admission to the Course in Ship Construction and Marine Transportation are given on page 19.

The purpose of this course is to prepare men to engage in the design, construction and operation of ships, and to enter the field of marine transportation. The course is a combination of engineering and economics preceded by the fundamental subjects common to engineering courses: chemistry, modern languages, physics and mathematics. Combining, as it does, engineering training with studies in economics and business administration, such a course offers great advantages. It has been planned to develop a class of men, who in addition to a knowledge of conditions governing ocean and inland water transportation, will have a command of the technical, economic, and financial problems of ship design, construction and operation.

The first and second years are devoted largely to physics, modern languages, chemistry, engineering drawing, and mathematics, all of which afford necessary preparation for the technical work in later years. The course in Construction of the Freshman year is designed to give a general idea of the scope of engineering. Students continue in the Freshman year the modern foreign language accepted for entrance. In the Sophomore year they may elect French, Spanish or German.

The second year schedule, although largely concerned with science, embraces some preliminary work in engineering and economics. There is a detailed study of ship construction, including lectures and class room work covering the main features of ship construction, and also work in the drawing room where drawings of ship construction are worked up by the student. In the second term the student fairs up a set of ship's lines and cuts a model from his own lines. Both the transverse and longitudinal types of construction are given full treatment in this course. The study of naval architecture is begun in the second term of the second year and is continued in the first term of the Junior year.

The Junior year schedule includes these fundamental engineering subjects: Strength of Materials, Hydraulics, Naval

Architecture, Steam Engineering, Machine Design, Marine Engineering, and Electrical Engineering. Class room work in most of the subjects is supplemented by exercises in the laboratories. In the first term of the third year a study is made of the theory of heat engineering and thermodynamics. This course is followed in the second term by a study of marine engineering with special emphasis on the selection and layout of the marine power plant and economic problems in marine engineering.

The work in the Senior year completes the work in Naval Architecture and takes up the study of Ship Design, Marine Engines and Turbines, Metallurgy, Structural Steel Design and Reinforced Concrete, economics, and marine transportation.

An important feature of the Lehigh Course in Ship Construction and Marine Transportation is the large amount of time devoted to the study of economics and allied subjects. To arouse the student's interest and to fit him for work in marine transportation and foreign trade, instruction in Economics and Accounting is given in the Sophomore year, followed by Business Law and Finance in the Junior year, and by Marine Insurance and Foreign Exchange, Foreign Trade, and Industrial Management in the Senior year.

Surveying is given during four weeks of the summer term immediately following the close of the Freshman year.

Students are required to do summer work in shipyards and on shipboard, and the department co-operates in finding positions for them. The summer following the Sophomore year is spent in a shipyard. This brings the student into direct contact with practical ship construction and shipyard practices, so that he unconsciously acquires a knowledge of proportions and dimensions of engineering structures. The summer following the Junior year is spent at sea so that the student may observe the action of a ship at sea, and study the operation of the ship's power plant.

A pamphlet, giving further details, may be obtained by addressing the Registrar.

Graduates of this course receive the degree of Naval Engineer (N.E.).

THE COURSE IN SHIP CONSTRUCTION AND MARINE TRANSPORTATION

FIRST TERM	FRESHMAN YEAR	SECOND TERM	
Advanced Algebra (3)	143	Plane Analytic Geom. (3)	145
Elementary Chemistry (2)	390	Qualitative Analysis (3)	395
Chemical Lab. (2)	391	Stoichiometry (1)	397
Elementary Mechanics (3)	320	Elem. Mech. & Heat (3)	321
French (3)	94	Physical Measurements (1)	322
or Spanish (3)	111	French (3)	94
or German (3)	75	or Spanish (3)	111
Engineering Drawing (3)	160	or German (3)	75
Construction (1)	162	Engineering Drawing (2)	161
Mil. Sci. & Tactics (2)	470	Construction (1)	163
Military Drill (½)	470	Mil. Sci. & Tactics (2)	470
Gymnasium (½)	500	Military Drill (½)	470
		Gymnasium (½)	500

SUMMER TERM: Land and Topographic Surveying (3), 164.

FIRST TERM	SOPHOMORE YEAR	SECOND TERM	
Differential Calculus & Solid		Integral Calculus (4)	147
Analytic Geom. (4)	146	Light & Sound (3)	325
Elec. & Magnetism (3)	323	Light, Elec. & Mag. Lab. (1)	326
Mech. & Heat Lab. (1)	324	English (2)	124
English (2)	123	French (3)	91 or 95
French (3)	91 or 95	or Spanish (3)	110 or 113
or Spanish (3)	110 or 113	or German (3)	71, 79
or German (3)	70, 78	Naval Architecture (2)	452
Ship Construction (3)	450	Ship Construction (2)	451
Economics (2)	16	Accounting (2)	20
Mil. Sci. & Tactics (2)	471	Mil. Sci. & Tactics (2)	471
Military Drill (½)	471	Military Drill (½)	471
Physical Education (½)	500	Physical Education (½)	500

SUMMER TERM: Work in Shipyard on Hull Construction (3).

FIRST TERM		JUNIOR YEAR		SECOND TERM	
Strength of Materials (4)	167	Hydraulics (3)	171		
Strength of Materials Lab.(1)	168	Hydraulic Lab. (1)	172		
Naval Architecture (3)	453	Alternating Currents (2)	375		
Dynamos & Motors (2)	354	Dynamo Lab. (1)	356		
Dynamo Lab. (1)	355	Marine Engineering (3)	455		
Heat Engineering (3)	225	Machine Design (3)	202		
Business Law (2)	31	Steam Engineering Lab. (1)	211		
Astronomy & Navigation (2)	150	Finance (2)	18		
Physical Education (1)	500	Economic Geography (3)	35		
		Physical Education (1)	500		

SUMMER TERM: At Sea or in Shipyard Machine Shop (3).

FIRST TERM		SENIOR YEAR		SECOND TERM	
Naval Architecture (2)	454	Metallurgy (3)		247-249	
Ship Design (3)	457	Ship Design (4)		458	
Marine Engs. & Turbines (4)	226	Reinforced Concrete (3)		185	
Steam Engineering Lab. (1)	216	Contracts & Specifications (2)		184	
Structural Steel Design (4)	456	Foreign Trade (4)		29	
Industrial Management (2)	24	Shipyard Plants &			
Foreign Exchange & Marine		Terminal Facilities (3)		459	
Insurance (3)	28	Physical Education (1)		500	
Physical Education (1)	500				

Figures in parentheses indicate number of credit hours a week. Other figures indicate course numbers.

LIST OF STUDIES

Following is a complete list of studies offered by the University in its various courses. The number of exercises a week in each subject is indicated by the figures in parentheses. Two hours of drawing, three of work in the laboratory or three of practice in the field are regarded as equivalent to a recitation or lecture of one hour's duration.

UNDERGRADUATE COURSES

PHILOSOPHY, PSYCHOLOGY AND EDUCATION

PROFESSOR HUGHES, ASSISTANT PROFESSOR DROWN

1. GENERAL PSYCHOLOGY. Physiological Psychology, Hunter, first term; *Social Psychology*, MacDougall, second term. A course for B.A. students. First and second terms (3).

2. PRINCIPLES OF PSYCHOLOGY. *General Psychology*, Hunter, first term; readings in applied psychology, with special emphasis on MacDougall's *Social Psychology* and Link's *Employment Psychology*, second term. A course for Business Administration students. First and second terms (2).

3. PSYCHOLOGICAL PROBLEMS. Measurement of intelligence. studies in genius and in mental deficiency and abnormality. First term (2).

4. SOCIAL PSYCHOLOGY. The group mind. The relation to essential human needs of the several forms of culture,—sport, art, the moral and religious consciousness, the spirit of science; their origin and development. Second term (2).

5. ECONOMIC PSYCHOLOGY. An introduction to such works as Link's *Employment Psychology*. Tead's *Instincts in Industry* and texts on advertising and salesmanship. A course especially intended for students in engineering. First or second terms (1).

6. EXPERIMENTAL PSYCHOLOGY. A course for Seniors who wish to follow up some line of investigation touched on in the Junior year. First and second terms (1).

PHILOSOPHY

7. HISTORY OF PHILOSOPHY. An introduction to the philosophical method of dealing with the essential problems of an epoch. Rogers' *Student's History*. First term (2).

8. HISTORY OF PHILOSOPHY, continued. The philosophical enterprises of recent years. Perry's *The Present Conflict of Ideals*. Second term (2).

9. SCIENTIFIC METHOD. *Essentials of Logic*, Sellars; "*How We Think*," Dewey. Sophomores. Second term (3).

EDUCATION

10. HISTORY OF EDUCATION. Special emphasis upon Greek education and upon the roots of our present educational systems and methods. Graves. First term (3).

11. INTRODUCTION TO HIGH SCHOOL TEACHING. A preliminary discussion of teacher and adolescent as the personal factors of the problem. The conduct and routine of class room practice, methods, types of lesson, daily plans, questions, devices and illustrative material, economy in teaching, discipline, tests, reports, etc. Colvin's *Introduction to High School Teaching*. Collateral readings. Juniors. First term (3).

12. PRINCIPLES OF SECONDARY EDUCATION. The fundamentals of method, including the philosophy of the project method. Dewey, Kilpatrick, Thorndike and Hosic. Problems of administration, including a study of the development of secondary school systems, junior high schools and junior colleges. Social factors. Problems of the curriculum. Inglis' *Principles of Secondary Education*. Juniors. Second term (3).

13. SENIOR EDUCATION. Preparation for the type of teaching position the student expects to fill. Special Method: in Latin, course 54, Professor Blake; in German, courses 81 and 82, Professor Palmer; in Romance Languages, course 96, Professor Fox; in Physics, course 336, Professor MacNutt. Specialization in certain other fields under the supervision of a competent teacher in nearby public or private schools, as stated on page 38. Observation with practise teaching is required of all students taking this course. First and second terms (3).

14. PRACTISE TEACHING. Work in connection with other courses and extra work. The student who seeks the State Department's provisional college certificate to teach (see page 37) should take practise teaching yielding at least five term hours of college credit. Three of these hours may be supplied by work in courses 10 and 11 and two to four hours by work in

course 12. Extra work along desired lines may be arranged, yielding credit of one term hour in any given term. (1.)

15. SCIENCE AND SCIENTISTS. Given during 1919-1920 and 1920-1921 as part of course 47. The intellectual development of man revealed as the underlying cause of social and political progress. Libby's *An Introduction to the History of Science*. First and second terms (1).

BUSINESS ADMINISTRATION*

PROFESSOR STEWART, PROFESSOR FOX,
ASSOCIATE PROFESSOR BICKLEY, ASSISTANT PROFESSOR CURTIS,
MR. MAC GREGOR

ECONOMICS

16. ECONOMICS. A study of the elementary principles of political economy. Lectures and required reading in selected works. First term (3) or (2).

17. ECONOMICS. Practical economic problems; taxation, transportation, finance, labor, trusts, and monopolies. Second term (3).

18. BUSINESS FINANCE. A study of the financial needs of the different forms of industrial organization, including individual proprietorship, partnership, corporation, and holding company, together with various means of meeting these needs. Second term (2).

18a. CORPORATION FINANCE. A study of the means of financing a corporation, including the sale of commercial paper, common and preferred stock, debenture and mortgage bonds, promotion of new corporations, underwriting, re-organization and receivership. First and second terms (3).

19. PUBLIC FINANCE. Government expenditures and their relation to the functions of government and to social, political and industrial conditions; formulation of budgets; nature and employment of public credit; origin and growth of public debts; revenues from various sources, with reference both to the theory and to the practise of various nations. First and second terms (3).

20. ACCOUNTING THEORY AND PRACTICE. A study of the fundamental principles of accounting with sufficient practise work to illustrate these principles. Theories of debit and credit; single and double entry; construction of accounts; special books; dis-

inction between capital and revenue and the problem involved; construction and analysis of financial statements; equity accounts; valuation of assets; methods and problems of depreciation. The economic aspects of accounting are emphasized. First term (3), or second term (2).

21. CORPORATION ACCOUNTING. (Elective, Junior year.) The application of accounting principles to corporations, corporation accounts and records. The voucher system; construction and analysis of corporate statements and reports; assets of corporations and their valuation; capital stock and the stock books; bonds and other forms of indebtedness; distribution of profits; handling surplus and reserves; sinking and other funds; liquidation of a corporation; combinations and consolidations; branch house accounting. Considerable practice work is given during the second term. The problems are selected largely from examinations for Certified Public Accountancy. First and second terms (3).

21a. AUDITING. (Elective, Senior year.) Procedure in conducting an audit; detection of errors and defalcations; financial conditions of a business as revealed by the accounts and other sources of information. The social responsibilities of auditing. First term (3).

21b. MANUFACTURING ACCOUNTS. (Elective, Senior year.) The various systems of manufacturing accounts for different types of manufacturing enterprises; choice of methods to meet peculiar needs; installing cost systems; forms and records; manufacturing accounts as an aid to and as a check on production efficiency; preparation of reports for executives. Second term (3).

22. TRANSPORTATION. Development of transportation facilities. Consideration, from the administrative viewpoint, of railways and waterways as factors in the social and industrial development of the United States. The organization of railways, considering charters and franchises, capital stock, directors and stockholders. The administration and operation of railways, considering the activities of the various departments,—transportation, traffic, executive, financial, and legal. Relations between railroads and their employees. Public regulation and control of transportation facilities. First and second terms (2).

23. LABOR LEGISLATION AND ADMINISTRATION. Labor problems confronting the employer and the more successful methods of meeting them and avoiding legal disputes. The legal status of unions and strikes. Protection of the employer's interests. Employer's Liability and Workmen's Compensation Acts. First and second terms (3).

24. DEVELOPMENT OF ECONOMIC THOUGHT. The rise and development of economic systems and economic thought; the scope and method of political economy. Patten's *Development of English Thought* and the works on political economy of Keynes, Cohn and Ingram are used. First and second terms (3).

25. INVESTMENTS. A comparative study of investment values (including bonds, stocks, notes, and mortgages) and the conditions affecting the investment market; with the emphasis on the securities of corporations as investments. First and second terms (3).

26. STATISTICS. Statistical method and applied statistics. Practice is given in the handling and especially in the interpretation of statistics. As much research as possible is carried on. First and second terms (3).

27. BANKING AND CURRENCY. A study of the banking system of the United States, comparing it with those of the important European states, together with a study of the currency and currency problems of this country. Special emphasis is laid upon the Federal Reserve Act, foreign exchange, and factors affecting the money market. First and second terms (3).

28. FOREIGN EXCHANGE AND MARINE INSURANCE. Foreign monies and exchange ratios, financing of exports and imports, factors determining exchange rates, statistical studies in the field of foreign exchange, instruments and forms used in foreign trade; principles of insurance and the peculiarities of marine risks and policies. First term (3).

29. FOREIGN TRADE. An historical and statistical study of international trade; the organization of steamship lines; combines, export associations, and rate agreements; line and charter traffic and trade routes. A study of steamship ports and the influence of the hinter land with special attention to the relations of navigation or inland waterways and railway transportation to ocean commerce. The course also includes a study of the special methods necessary for successful trading with certain undeveloped but progressing nations. Second term (4).

30. SUMMER READING IN ECONOMICS. Assignments for summer of 1921. Freshman: RESOURCES. *The Conservation of Natural Resources*, Charles R. Van Hise. Sophomore: INDUSTRIAL SOCIETY. *Readings in Industrial Society*, Leon C. Marshall. Junior: INDUSTRIAL ADMINISTRATION. *The Works Manager Today*, Sidney Webb; *Organizing for Work*, H. L. Gantt; *Instincts in Industry*, Ordway Tead.

LAW AND POLITICAL SCIENCE

31. ELEMENTS OF BUSINESS LAW. The principles of contract; formation of contracts; operation and discharge of contracts; sales of goods; insurance contracts; negotiable instruments. First term (2) or (1).

32. ELEMENTS OF BUSINESS LAW. Principal and agent; master and servant; business associations; partnerships and corporations. Second term (2) or (1).

33. CONSTITUTIONAL LAW. The constitutional framework and the practical operation of the Federal and State governments. The relation of government to the business and social interests of the people. Interpretation of the Constitution by the various departments of the government. Comparison of American and European practice. First and second terms (3).

34. INTERNATIONAL LAW. The development of international law; its origin and history; economic and political changes determining the development of international relations; the Jus Gentium of the Roman Law and the "Natural Law" jurists. Law of Peace and War: general principles governing the normal relations of states and their relations in time of war. The Law of Neutrality, with special reference to the contributions of the United States; problems associated with blockade, contraband of war, unneutral service. First and second terms (3).

ECONOMIC GEOGRAPHY

35. ECONOMIC GEOGRAPHY OF NORTH AND SOUTH AMERICA. Physical features, climate, and resources of the Western Hemisphere; their influence upon the economic, political, and social institutions. The present and prospective commercial relations of the United States with Mexico, Central and South America. First and second terms (3).

36. ECONOMIC GEOGRAPHY OF THE EASTERN HEMISPHERE. Physical features, climate, and resources of the Eastern

Hemisphere; their influence upon the economic, political, and social institutions. Study of Great Britain, Germany, Russia, China, Japan, India and the Philippine Islands; the present and prospective commercial relations of these countries with the United States. First and second terms (3).

HISTORY

PROFESSOR STEWART, MR. MAC GREGOR

38. INDUSTRIAL HISTORY. The evolution of modern industrial conditions as found in the growth of the economic powers of Great Britain, Germany and the United States. First and second terms (3).

39. THE POLITICAL AND CONSTITUTIONAL HISTORY OF THE U. S. PRIOR TO 1860. The era of constitution making, state and federal. Rise and growth of party government. The development of nationality and democracy. Political and constitutional questions arising in connection with internal improvements, the tariff, the bank and slavery. First and second terms (3).

40. POLITICAL AND CONSTITUTIONAL HISTORY OF THE U. S. SINCE 1860. A continuation of the preceding course. Given alternately with course 41. First and second terms (3).

41. EUROPEAN HISTORY. The formation of the modern European nationalities. The rise of the universities. The revival of learning. The Reformation. The relations of Europe and America. First term (3).

42. EUROPEAN HISTORY. The history of modern Europe. The development of Great Britain. The French Revolution and the history of the Nineteenth Century. Second term (3).

43. AMERICAN FOREIGN RELATIONS. Studies in the diplomatic relations of the United States with the main countries of Europe, with the Near East and the Far East. First term (3).

44. UNITED STATES AND LATIN AMERICA. Problems arising out of the relations of South American states to one another and to the United States. Origin, development and application of the Monroe Doctrine. Second term (3).

LATIN

PROFESSOR BLAKE

45. LIVY. Selections from the books covering the war with Hannibal. Particular attention to forms and the usages of

normal syntax. Latin prose compositions using Arnold's *Latin Prose*. Written translations from Latin into English. History of the struggle between Rome and Carthage. Freshman, first term (3).

46. HORACE. *Odes* and *Epodes*. Insistence upon tasteful translation. Constant practice in metrical reading. Memorizing of some of the odes of Horace. Latin prose composition, continued. Freshman, second term (3).

47. ANCIENT AND MEDIAEVAL LITERATURE AND HISTORY. A course aiming to impart a knowledge of ancient and mediaeval civilization and literature by means of required readings in available English translations of writings of the times, as well as by means of text-books dealing with the course of events. Freshman, first and second terms (3).

Courses 45 and 46 are required of Freshmen in the B.A. course who enter with four units in Latin; others in that course take 47, except that those who present three units in Latin for entrance may, upon the approval of the Professor of Latin, continue Latin instead.

48. PLINY. Selected letters. Tacitus. *Agricola* and *Germania*. Consideration of social and legal usages suggested by Pliny. Some study of Roman provincial administration. Sophomore, first term, elective (3).

49. PLAUTUS AND TERENCE. Careful study of a play of each, with rapid reading of as much more as time permits. Study of dramatic verse-structure and practice in metrical reading. History of the drama at Rome. Sophomore, second term, elective (3).

50. TACITUS. Selections from the *Histories* or *Annals*. Some consideration of Tacitus as an historian and a literary artist. Sight-reading from Suetonius. Junior or Senior, first term, elective (3).

51. JUVENAL. Selected *Satires*. Selections from Martial. Satire and epigram in Roman literature. Study of social conditions under the empire as evidenced by the writings of the younger Pliny, Tacitus, Suetonius, Juvenal, and Martial. Writing of brief dissertations on assigned topics. Junior or Senior, second term, elective (3).

52. ROMAN LAW. An elementary course. Reading and comment on selections from the Institutes of Justinian, or Gaius. Brief survey of Roman constitutional history and the develop-

ment and contents of the body of Roman Law, in connection with Morey's *Outlines of Roman Law*. Junior or Senior, first term, elective (3).

53. LUCRETIVS. Careful study of one book entire of *De Rerum Natura*, with reading of selections from the other books. Consideration of textual questions. Discussion of ancient materialistic theories. Some review of Roman philosophy and ethics. Junior or Senior, elective, second term (3).

54. Courses for prospective teachers of Latin in secondary schools. Largely a review of secondary school Latin, the members of the class conducting the class in turn under the oversight of the Professor of Latin to the end that they may enter upon the teaching of Latin in preparatory or high school with freshened knowledge of the subject, and not without some experience in presenting it. Junior year, first term (2), second term (2). This course will ordinarily be taken in connection with EDUCATION, which see.

GREEK

PROFESSOR GOODWIN

55. LYSIAS, Selected *Orations*; or XENOPHON, *Memorabilia*. Review of the Grammar. Composition and other exercises. Careful study of Attic prose syntax; special attention to the formation of correct methods of study and translation, to grammatical analysis, and the reading aloud of Greek. Available time is employed in sight-reading. HERODOTUS. One book begun. First term (3).

56. HERODOTUS (continued). Study of the forms and syntax of the Ionic dialect. PLATO. *Euthyphro* and *Apology*, or other shorter dialogues. Introduction to Greek Philosophy. Grammar and Composition as in the first term. Second term (3).

57. THUCYDIDES. One or more books. Practical exercises, including composition. First term (3).

58. TRAGEDY. EURIPIDES. *Medea*, *Bacchae*, or another play. SOPHOCLES. *Oedipus Tyrannus*, *Antigone*, or another. Literary study of the drama. Poetical language, style, and conception. Metrical reading. Composition. Second term (3).

59. DRAMATIC POETRY (continued). AESCHYLUS. *Agamemnon*, or *Prometheus Bound*. ARISTOPHANES. *Clouds*, *Frogs*, or *Birds*. ARISTOTLE. Chapters from the *Poetics*. Aristophanes as humorist and as moralist, with consideration of the tendencies which he satirized. Metres. Elementary text-criticism. First term (3).

60. GREEK ORATORY. Jebb's *Selections from the Attic Orators*. DEMOSTHENES. Selected orations. Rapid reading, the student being supposed to have reasonable facility in understanding the Greek directly without rendering into English. Attention is directed largely to those points which illustrate the development of Greek prose style. Second term (3).

61. HOMER. Rapid reading of considerable portions of the *Iliad* or *Odyssey*. Homeric language, syntax, and metre reviewed, with some reference to the needs of intending teachers, but chiefly as a foundation for the study outlined in course 62. First term (3).

62. LYRIC POETRY. Fragments of the Elegiac, Iambic, and Melic Poets. Selections from PINDAR or THEOCRITUS. Study of the development of poetry in Greece. Second term (3).

63. HELLENISTIC GREEK. *New Testament*. Selections from LUCIAN. To be substituted on occasion for 62. Second term (3).

Courses 59 and 61, 60 and 62 are given in alternate years, and are open to both Juniors and Seniors.

Candidates for honors in Greek will be assigned special readings on request.

64. ELEMENTARY GREEK. A course offered in alternate years to Freshmen or Sophomores who have entered without Greek, but desire to take up the study in college. They perform in two years approximately the amount of work required for admission from those who present Greek, and are prepared to proceed in the third year with course 55. The introductory book and a portion of the *Anabasis* are studied in the first two terms. Given in 1920-1921; to be omitted in 1921-1922. First and second terms (3).

65. ELEMENTARY GREEK, second year. *Anabasis* continued; *Iliad*; Grammar and simple Composition. Omitted in the years in which the preceding course is given. First and second terms (3).

GERMAN

PROFESSOR PALMER,

ASSISTANT PROFESSOR MORE, MR. ROEST

70. ELEMENTARY GERMAN. German Grammar and Composition. Easy German texts. First term (3).

71. ELEMENTARY GERMAN, continued. Composition based on work in the Grammar. Dictation. Reading of short stories by various modern authors. Second term (3).

72. ELEMENTARY GERMAN. A condensed course for Chemical Engineers who have entered without German. Grammar. Readings in the German of Chemistry. First and second terms (3).

73. GERMAN. Rapid reading of selected texts on chemistry. For Sophomores who have passed course 72. First term (1).

74. SCIENTIFIC GERMAN. Rapid reading of scientific texts. For Seniors in the Department of Chemical Engineering who offered French or Spanish for entrance. Prerequisite course 72 or equivalent. Second term (3).

75. GERMAN. Thorough review of German Grammar. Prose composition. Modern German Prose; Scientific German. First and second terms (3).

76. GERMAN. The German of Chemistry. Review of German Grammar. Composition. First and second terms (3).

77. GERMAN. German Prose and Poetry. Heine, Keller, C. F. Meyer, Freytag, Storm, Heyse. Composition. First and second terms (3).

78. GERMAN. Modern German Prose. Rapid reading of representative texts. First term (3).

79. GERMAN. Goethe's *Faust*. Study of Part I. Lectures on the origin and development of the Faust story. Second term (3).

80. GERMAN. Nineteenth Century German Drama. Lectures, reading, reports on assigned work. First and second terms (3).

81. GERMAN. Goethe's Dramas: *Goetz*, *Egmont*, *Iphigenie*, *Tasso*, *Faust*, Part II. First and second terms (3).

82. GERMAN. The German Short Story, its origin and development. Rapid reading of illustrative stories, with particular attention to Gottfried Keller, Theodor Storm, C. F. Meyer, and Paul Heyse. Lectures and reports. First and second terms (3).

83. GERMAN. A course for prospective teachers in advanced German grammar, German composition, methods of teaching and discussion of text-books. First term (2).

ROMANCE LANGUAGES

PROFESSOR FOX, ASSISTANT PROFESSOR TOOHY, MR. CANONICO,
MR. EWING

FRENCH

90. ELEMENTARY FRENCH. Elementary French Grammar. Easy readings in French prose. Practice in speaking and writing simple French, based upon the texts used. A course intended primarily for Junior students in the College of Arts and Science; introductory to course 97. First and second terms (3).

91. ELEMENTARY FRENCH. An elective for Sophomore students in the course in Ship Construction and Marine Transportation. Emphasis upon the development of a reading knowledge of French. Grammatical drill limited to the essentials. First and second terms (3).

92. ELEMENTARY FRENCH. A Sophomore elective for students in the College of Arts and Science who wish three years of French and can therefore give time to a more detailed drill in grammar and composition as well as practice in writing and Science; introductory to course 97. First and second terms (3).

93. FRENCH. A course for students who wish a greater opportunity to practice in the oral and written use of modern French prose. Especially recommended for those who expect to teach French. First and second terms (2).

94. FRENCH. A course for Freshmen who enter on French. Thorough review of the grammar with composition work, both oral and written, based upon the grammar and upon the texts read. Texts selected from writers of modern French prose. First and second terms (3).

95. FRENCH. Primarily for students in Ship Construction and Marine Transportation who elect to continue the French of their Freshman year. Rapid reading of modern French authors, introducing certain of the social and political problems of France and her people today. Reading of texts by such authors as Thiers, Lamartine and Michelet, to furnish the necessary background. First and second terms (3).

96. FRENCH. Text and methods. First or second term, or both (1) or (2).

97. FRENCH. Rapid reading. Sight translation. Dictation. Oral drill in the use of a practical vocabulary. First and second terms (3).

98. FRENCH PROSE AND POETRY. Balzac, Flaubert, Maupassant, Daudet, Zola. First term (3).

99. FRENCH PROSE AND POETRY. Continuation of course 98. Molière, Corneille, Racine. Society in the seventeenth century. Second term (3).

100. FRENCH. French literature in the seventeenth century. First term (3).

101. FRENCH. French literature in the eighteenth century. Second term (3).

102. FRENCH. French literature in the sixteenth century and earlier. First and second terms (3).

103. FRENCH. General review of French Literature. Reading, lectures and explanation of texts. First and second terms (3).

104. FRENCH. French literature in the nineteenth century. First and second terms (3).

SPANISH

110. SPANISH. Grammar, reading and composition. A course open to all students of the University. First and second terms (3).

111. SPANISH. Preparation required: 110 or equivalent. Reading and discussion in Spanish of texts dealing with the history of Latin American countries. Prose Composition. First and second terms (3).

112. (Alternate.) Spanish novels and plays. Short outline of Spanish literature. A second year course, intended more especially for students in the B.A. course; may be substituted by them for course 111, dealing with Latin America. First and second terms (3).

113. SPANISH. Reading and discussion in Spanish of texts dealing with the commercial and industrial relations of Latin America. Spanish commercial correspondence. First and second terms (3).

PORTUGUESE

114. PORTUGUESE. Grammar and composition. Rapid reading of modern literature, with particular reference to the

history, social and economic conditions of Brazil and Portugal. First and second terms (3).

115. PORTUGUESE. A continuation of course 114. First and second terms (3).

ITALIAN

116. ITALIAN. Grammar and composition. Rapid reading of easy modern prose. First and second terms (3).

117. ITALIAN. Masterpieces of the classic periods; outside reading. First and second terms (3).

ENGLISH

PROFESSOR THAYER, PROFESSOR LUCH,
ASSISTANT PROFESSOR MESCHTER, ASSISTANT PROFESSOR WALTERS,
MR. LAMBERT

120. RHETORIC. A composition course based on Genung's *Working Principles of Rhetoric* and other books, involving recitations and weekly themes on assigned subjects. First term (2).

121. AMERICAN LITERATURE. Lectures on the basis of Cairns' *History of American Literature* and other text-books, as assigned. The examination is based upon the text-book and the student's notes. First term (1).

122. HISTORY OF THE ENGLISH LANGUAGE. Lectures and classroom work, with the use of Emerson's *Brief History of the English Language* as a text-book, supplemented by Lounsbury's and Champneys'. Second term (2).

123. ENGLISH LITERATURE. An outline course developed by lectures and recitations, with parallel readings assigned annually. Text-book: Pancoast's *English Literature* with a standard book of selections from English Literature. First term (2).

124. LITERARY CRITICISM. Subject varies annually between topics taken from Elizabethan Literature, lyric or dramatic, and from Nineteenth Century Literature, earlier or later period. Second term (2). In 1922, Byron, Shelley, Keats and Landor.

125. ORATORY. A formal course based upon Foster's *Argumentation*, with recitations and writings of briefs, the composition and delivery of orations, and speeches on topics of current interest. First and second terms (1).

126. ANGLO-SAXON. Sweet's *Anglo-Saxon Primer and Reader*, with lectures on early English Literature, and readings from Brooke and Earle. First term (3).

127. JOURNALISM. A course of practical exercises in writing on scientific subjects and in the principles of journalism. Text-books: Bleyer's *Newspaper Writing and Editing* and Earle's *Technical Writing*. First term (3), repeated in second term (3).

128. ENGLISH PHILOLOGY. The principles of the Philology of the English language as developed in the works of Earle, Trench, Morris and Skeat. By a process of elimination the elements derived from Romance and other sources are excluded, and the residuum examined, in vocabulary and grammar, as a Teutonic language; with special reference to the intensive development of the tongue before the Age of Chaucer. Preparation required: 126. Second term (3).

129. NINETEENTH CENTURY LITERATURE; later period 1830-1892. A special study of Tennyson, Arnold and Browning and some of the minor poets. First term (1).

130. MIDDLE ENGLISH. A critical study of the English of Chaucer, Langland, Wiclif and Gower; followed by the literary study of selected specimens of their works. As text-books, *The Student's Chaucer*, Skeat's edition of *The Vision of Piers the Plowman*, Wiclif's translation of the *New Testament*, revised by Purvey, and Gower's *Confessio Amantis* are assigned. First term (3).

131. POETICS. A course based on Gummere's *Handbook of Poetics*, Alden's *English Verse*, Saintsbury's *Loci Critici*, and the use of Palgrave's *Golden Treasury*, and *The Oxford Book of English Verse*, with practical exercises in verse-composition. Second term (3).

132. DRAMA OF THE PAST. Based on Brander Matthew's *Chief European Dramatists*; with lectures, interpretations and a close study of plots and sources. First term (3).

133. CONTEMPORARY DRAMA. Lectures, criticisms and reading of typical plays. In 1922, American Drama. Second term (1).

134. THE DANISH ELEMENT IN ENGLISH. A philological study based on Sweet's *Icelandic Primer*, Groth's *Danish Grammar* (pp. 1-29, 67-143) and the works of Jespersen and other philologists. Alternative with 130. Preparation required: 126, 128. Second term (3).

135. Optional courses on the Rise and Development of the English Novel and on the Arthurian Cycle offered in alternate years. These are both lecture courses, with private reading assigned; and if supplemented by a rigid examination, will be taken as equivalent to one term's work in any class above the grade of Freshman.

136. ENGLISH CONFERENCES. Second term (2).

MATHEMATICS AND ASTRONOMY

PROFESSOR THORNBURG, PROFESSOR LAMBERT, PROFESSOR OGBURN,
ASSISTANT PROFESSOR STOCKER, ASSISTANT PROFESSOR REYNOLDS,
ASSISTANT PROFESSOR KNEBELMAN, DR. LEYZERAH,
MR. SOLT, MR. BUNN

140. SOLID GEOMETRY, beginning with Book VI and completing the subject. Second term (3).

141. TRIGONOMETRY. Plane Trigonometry, including the theory and use of logarithms. First term (3).

142. TRIGONOMETRY. Spherical Trigonometry, including the use of logarithmic tables. Second term (1).

143. ADVANCED ALGEBRA, beginning with the Theory of Quadratic Equations. Review of Plane Trigonometry. First term (3).

144. HIGHER ALGEBRA. Theory of Equations and other topics. First term (1).

145. PLANE ANALYTIC GEOMETRY. Graphic representation of loci on cross-section paper, plane analytic geometry. Second term (3).

146. DIFFERENTIAL CALCULUS AND SOLID ANALYTIC GEOMETRY. Embracing applications to analytic geometry and practical problems. Preparation required: 145. First term (4).

147. INTEGRAL CALCULUS. General integration methods with applications to theory of center of gravity, moment of inertia, together with a short chapter on elementary ordinary differential equations. Preparation required: 146. Second term (4).

148. DIFFERENTIAL EQUATIONS. Preparation required: 147. First term (1).

149. ANALYTIC MECHANICS. Differential equations of motion, treatment of forces in space, free and constrained motion of a particle and of masses, with applications to practical problems. Preparation required: 147. First term (2).

150. **DESCRIPTIVE ASTRONOMY.** A study of the fundamental facts and principles of the subject with solution of problems; observatory visits. First and second term (2) or (3).

151. **PRACTICAL ASTRONOMY.** Study of instruments used, methods of taking and reducing observations to determine time, latitude, longitude and azimuth; observatory work in which each student makes his own observations and computations in illustration of the problems studied. As this study is primarily for civil engineers, the sextant and engineer's transit are the chief instruments employed in the observational work. Preparation required: 147, 150. First term (3).

152. **ANALYTIC MECHANICS.** Preparation required: 147, 148, 149. Second term (3).

CIVIL ENGINEERING

PROFESSOR FOGG, PROFESSOR WILSON, PROFESSOR CHAPMAN,
ASSISTANT PROFESSOR BECKER, ASSISTANT PROFESSOR FULLER,
ASSISTANT PROFESSOR PAYROW, ASSISTANT PROFESSOR LEWIS,
MR. UHLER

160. **ENGINEERING DRAWING.** The use of drawing instruments. Lettering and tracing. Mechanical drawing from objects. Simple projections. Isometric drawing. First term (3).

160a. **ENGINEERING DRAWING.** An abridgement of course 160 for students in Business Administration. First term (3).

161. **ENGINEERING DRAWING.** The descriptive geometry of projections, intersections, and developments. Plans, elevations and sections of simple structural details. Preparation required: 160. Second term (2).

161a. **ENGINEERING DRAWING.** An abridgement of course 161 for students in Business Administration. Second term (2).

162. **CONSTRUCTION.** Lectures planned to give the student a general view of various branches of engineering. Principal topics discussed: history and scope of engineering, the lives of some noted engineers and scientists; history and types of architecture; modern building construction, including steel frames and fire-proofing; masonry; materials of construction; water supply and sewage disposal; development and transmission of water power. First term (1).

163. CONSTRUCTION. Continuation of course 162. Second term (1).

164. LAND AND TOPOGRAPHIC SURVEYING. The theory and practice of land surveying, including computation of areas, dividing land, determining heights and distances. Map drawing and topographic signs. Field work with level and transit. Map drawing from students' field notes. Theory and use of stadia. Detailed field work in rough country; pen topography and contour maps. Illustrations with and problems in the sand box. Preparation required: plane trigonometry and mechanical drawing. Summer term; a recitation and seven hours of field work or drawing each week-day for four weeks beginning June 15, 1921.

165. STEREOTOMY. Problems in stone cutting, including plans for piers, culverts, and arches. Isometric drawings and linear perspective. Preparation required: 160, 161. First term (3).

166. GRAPHIC STATICS. Analysis of the stresses in roof trusses by the force polygon. Applications of the equilibrium polygon to the discussion of beams and girders. First or second term (2).

167. STRENGTH OF MATERIALS. The elasticity and strength of timber, brick, stone, and metals. Theory of beams, columns, and shafts, with the solution of many practical problems. Preparation required: 320, 321, 323, 147. First term (4).

168. STRENGTH OF MATERIALS LABORATORY. Fourteen experiments made by each student on wood, iron and steel to determine the action of materials under stress and to study the physical properties of materials of construction. The Fritz Engineering Laboratory, where this work is done, is equipped with 20,000, 50,000, 100,000, 300,000, and 800,000-pound machines for tension, compression, and flexure, a 50,000-inch-pound machine for torsion and other apparatus for special work. Preparation required: 167. First term (1).

169. ELEMENTARY MECHANICS OF MATERIALS. Brief introduction to elements of strength of beams, columns and shafts, especially as applied to elementary machine design. First term (1), or second term (1).

170. HIGHWAY ENGINEERING. The location, construction and maintenance of roads and pavements. Preparation required: 162, 163. First term (2).

171. HYDRAULICS. Hydrostatics and theoretical hydraulics. The flow of water through orifices, weirs, tubes, pipes, and channels. Naval hydromechanics. Hydraulic motors. The solution of many practical problems. Preparation required: 320, 321, 323, 147. Second term (3).

172. HYDRAULIC LABORATORY. Fourteen experiments made by each student in the hydraulic section of the Fritz Engineering Laboratory, which is equipped with pumps, weirs, turbines, water-wheels, meters and other apparatus for special work. Preparation required: 171. Second term (1).

173. ROOFS AND BRIDGES. The theory and computation of stress in roof and bridge trusses under dead, live and wind loads. Locomotive wheel loads on plate girders and bridge trusses. Preparation required: 167. Second term (3).

174. RAILROAD SURVEYING. Reconnaissance, preliminary and location methods, with the theory of curves and turnouts. Location of a line, with the preparation of profiles and maps. The computation of earthwork and estimates of cost. Preparation required: 164. Second term (4).

175. BRIDGE DESIGN. Lectures and recitations. Discussion of the theory of structural steel design and complete calculations for a through plate girder railroad bridge and for a highway truss bridge, both of which are designed and drawn in course 176. Preparation required: 173. First term (2).

176. BRIDGE DESIGN DRAWING. Complete shop drawing for a single track through railroad bridge and a design drawing of a highway truss bridge for which calculations are made in course 175. Preparation required: 173. First term (4).

177. HYDRAULIC ENGINEERING AND DESIGN. Three recitations and one drawing-room exercise a week devoted to systems of water supply, including purification systems, reservoirs, pipe lines, pumping plants. The design of a water supply distribution system. The measurement of flow in open channels by means of tubes and meters. Water power. Irrigation. Preparation required: 171. First term (4).

178. RAILROADS. The construction of the roadbed; including ballast, crossties, rails, switches, culverts and other details. Maintenance of way, and the elements of railroad operation.

Visits of inspection, with written reports. Lectures on the economics of railroad location; the arrangement of yards, stations and terminals, train resistance, the application of electricity to the operation of railroads. Preparation required: 174. First term (2).

179. GEODETIC SURVEYING. Recitations, calculations, field work. Precise leveling. Adjustment of instruments with investigation of their systematic errors. Elements of least squares and their application to the adjustment of triangulations. Field work in triangulation, in determination of azimuth, and with the plane table. Preparation required: 174. First term (3).

180. MILL BUILDINGS. Design, construction and layout of mill buildings. Preparation required: 173. First term (2).

180a. MILL BUILDINGS. An abridgement of course 180 for students in Mechanical Engineering. First term (2).

181. BRIDGES AND DAMS. Higher structures, including continuous, draw, cantilever and suspension bridges, also metallic arches. The theory and design of masonry walls, dams, and arches. Theory of deflections and applications to statically indeterminate structures. Preparation required: 175. Second term (4).

182. SANITARY ENGINEERING. Systems of sewerage and methods of sewage treatment and disposal. The design of a sewerage system. House drainage. Preparation required: 177. Second term (3).

183. REINFORCED CONCRETE. The manufacture, properties, and testing of hydraulic cement, mortar and concrete. All the standard tests made by each student on cement and on reinforced concrete beams and columns in the Fritz Engineering Laboratory. Reinforced concrete buildings, arches and other structures; theory of reinforced concrete. Preparation required: 175. Second term (4).

184. CONTRACTS AND SPECIFICATIONS. Lectures on the essentials of contracts and specifications for engineering structures. Second term (2).

185. REINFORCED CONCRETE. An abridgement of No. 183 for students in Ship Construction and Marine Transportation. Second term (3).

SUMMER SCHOOL IN CIVIL ENGINEERING

164. LAND AND TOPOGRAPHIC SURVEYING. Exercises in Land Surveying and Topographic Surveying, designed primarily for students of the University, but open to all persons prepared to take them, are given in the summer vacation. In 1921, this work begins at 8 a.m., on June 15, and ends on July 12. Students in Civil Engineering, Mining Engineering and in Ship Construction and Marine Transportation are required to take this work at the end of their Freshman year. The fee for other persons is \$20.

SUMMER WORK IN CIVIL ENGINEERING

During each summer following the Sophomore and Junior years students are required to spend at least eight weeks on shopwork or on engineering construction.

MECHANICAL ENGINEERING

PROFESSOR LARKIN, PROFESSOR DE SCHWEINITZ,
PROFESSOR KLEIN, ASSOCIATE PROFESSOR BUTTERFIELD,
ASSISTANT PROFESSOR BEAMENSDEFFER,
ASSISTANT PROFESSOR QUAST, MR. NORDENHOLT

200. DRAWING AND ELEMENTS OF MACHINE DESIGN. Orthographic, isometric and oblique projections, intersections and developments. Sketches and working drawings of machine pieces, tracings, details of screw-fastenings, keys and other fastenings. Students taking this course are required to take course 169, Elementary Mechanics of Materials. Text-book: French's *Engineering Drawing*. First term (3).

201. CONSTRUCTIVE ELEMENTS OF MACHINERY. Visits of inspection. Examination and sketching of machine parts and machinery. Inspection and study by each student of a classified and numbered list of some three hundred and sixty items. Taking apart and putting together of a score of machines of all sorts. Work accompanied by Constructive Elements of Electrical Apparatus, course 350. Summer term four weeks beginning June 15, 1921.

202. ELEMENTS OF MACHINE DESIGN. Calculation of the dimensions of elementary machine parts such as spur-, bevel- and worm-gears, pulleys, shafting, couplings, bearings, connecting rods, etc., from the forces acting upon or transmitted by such machine parts. Working drawings of these pieces.

Text-book: Leutwiler's *Elements of Machine Design*. Preparation required: 169 and 200. First or second term (3).

203. BOILERS. Description of various types, and details of construction, staying, setting, etc.; strength of the structure; accessories. Textbook: Peabody and Miller's *Steam Boilers*. First term (1).

204. STEAM ENGINES. Classification and types of engines, governors, valve gears; valve diagrams, indicator diagrams, efficiency. Fuels, combustion, boilers, superheaters, feed water heaters, condensers. Text-book: Hirshfeld and Barnard's *Heat Power, Engineering*. Second term (4).

205. HEAT ENGINES. Short course for students in courses other than Mechanical Engineering, covering Steam Engines, Steam Turbines, Internal Combustion Engines and Boiler Plants. Text-book: Hirshfeld and Barnard's *Heat Power Engineering*. First term (3).

206. HEAT ENGINES. Work of 205 completed. Second term (3).

207. STEAM AND GAS ENGINES. A combination of courses 205 and 206 for students in the Chemical Engineering course. Second term (4).

208. MECHANICAL TECHNOLOGY. Full written description required of the various processes, operations, and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings and finished pieces, which are under construction in the shops at the time. Personal direction of the student's work by an instructor, who accompanies him in each shop. Summer term, four weeks, beginning June 15, 1921.

209. GRAPHIC STATICS OF MECHANISMS. Graphical determination of the forces acting on all the various pieces constituting a machine, covering a great variety of machines; drawings of these machines given to the students. Consideration of frictional and inertia resistances and determination of the efficiencies of mechanisms. First or second term (2).

210. ENGINEERING LABORATORY. Use and calibration of apparatus for measuring weight, volume, pressure, temperature, speed, etc., for engineering purposes. Text-book: Carpenter & Diederich's *Experimental Engineering*. Fee, \$3.50. First term (2).

211. ENGINEERING LABORATORY. Work of 210 continued. Indicator practise on engines in the laboratory and in factories and power plants in the neighborhood; complete working up of indicator diagrams from simple and compound engines, air compressors, etc. Text-book: Carpenter & Diederich's *Experimental Engineering*. Fee, \$3.50. Second term (1).

212. MACHINERY OF TRANSMISSION. Treatment of the Mechanics of Machine Parts and determination of their dimensions from considerations of strength and durability. Analytical presentation of the subject of acceleration. First term (3).

213. THERMODYNAMICS. Proof of the fundamental laws; equations of condition for air and superheated steam; the relation between pressure, volume, temperature, work and heat for special changes of state. Establishment of the fundamental equations of thermodynamics and their adaptation to gases, saturated and superheated vapors, and technical problems connected therewith. First term (4).

214. KINEMATICS OF MACHINERY. A treatment of the constrained motion peculiar to machinery and of the nature and equivalence of mechanisms. Lectures, accompanied by a large amount of work in the drafting room. The construction of centrodes; inversions and skeletons of mechanisms; preparation of displacement, velocity and acceleration diagrams for a great variety of machines. Much practise in mass and force reductions, the latter including all forms of inertia resistance and external forces. Text-book: A. W. Klein's *Kinematics of Machinery*. Second term (4).

215. ADVANCED MACHINE DESIGN. The design of machines in general, with special attention to the calculation and designing of the various parts for strength, stiffness and other requirements. Problems covering such machinery as cranes, hoists, pumps, machine tools, hydraulic machinery, etc. First term (4).

216. ENGINEERING LABORATORY. Work of 211 and 213 continued. Test of boilers, of power plants and of pumping stations in the neighborhood. Advanced work along the lines of 214. Text-book: Carpenter & Diederich's *Experimental Engineering*. Fee, \$3.50. First term (1).

217. ENGINEERING LABORATORY. A shorter course, selected and condensed from 210, 211, 216, 218 and 221, especially in steam engineering, for students in Metallurgical and Mining and Electrical Engineering. Fee, \$3.50. First term (1).

218. ENGINEERING LABORATORY. Work of 217 completed, along same lines. Fee, \$3.50. Second term (1).

219. ADVANCED MACHINE DESIGN. A continuation of course 216, being more specialized. Second term (4).

220. MECHANICS OF MACHINERY. The principles involved in the design and construction of machinery such as hoisting, pumping, and air-machinery, locomotives, etc. Second term (3).

221. ENGINEERING LABORATORY. Work of 217 carried forward, along same lines. Analysis of flue gases; complete tests of the power plants of the vicinity. Text-book: Carpenter & Diedrich's *Experimental Engineering*. Fee, \$3.50. Second term (1).

222. GAS ENGINES. The Mechanics, Thermodynamics, Thermo-Chemistry, Construction, and Tests of the Gas Engine. Text-book and reference book: Streeter's *Internal Combustion Engines*. First term (3).

223. STEAM TURBINES. The Mechanics, Thermodynamics, Construction and Experimental Results of Stationary and Marine Steam Turbines. Text-book: Moyer's *Steam Turbines*. Second term (4).

224. MECHANICAL ENGINEERING. One or two of the following subjects: plant engineering, refrigeration, aeronautics, marine engines, etc. Second term (3).

225. HEAT ENGINEERING. The laws of gases and the gas cycles; the properties of steam and other vapors, the vapor cycles, entropy and the temperature-entropy diagram; a study of the theory of prime movers and the action of steam in engines and turbines; the use of the steam tables, the Mollier and temperature entropy diagrams. For students in the Course of Ship Construction and Marine Transportation. First term (3).

226. MARINE ENGINES AND TURBINES. A detailed study of the multiple expansion reciprocating engine, the steam turbine and the Diesel engine. A study of the theory, economy and design of these three prime movers in the class room supplemented by work in the drawing-room and laboratory. For

students in the Course in Ship Construction and Marine Transportation. First term (4).

227. PLANT ENGINEERING. A study of the organization and operation of industrial plants in the vicinity of the University. A course extending throughout the last two terms of the curriculum in Mechanical Engineering and covering a study of plant transportation, conversion, fabrication, power and accessories. Lectures, laboratory work, shop visits, and reports in the form of Mechanical Engineering Seminary. Preparation required, course 210. First and second term (1).

METALLURGY

PROFESSOR RICHARDS, ASSOCIATE PROFESSOR ROUSH,
ASSISTANT PROFESSOR BUTTS, ASSISTANT PROFESSOR PULSIFER

242. INTRODUCTORY METALLURGY. A course of lectures on the distribution of the ores, of the various metals, their geographical distribution and conditions of their production; their present economic and mechanical importance. When possible to arrange, visits are made to metallurgical plants, to acquaint the student with the general features of metallurgical apparatus, their appearances and their working. First and second terms (1).

243. PHYSICAL METALLURGY. A general study of the chemical and physical properties of the various metals as related to their commercial applications. First term (1).

244. GENERAL METALLURGY. Metallurgical processes. Principles of combustion. Application of thermo-chemistry. Measurements of high temperatures. Fuels, natural and artificial, solid, liquid and gaseous. Fluxing. Refractory materials. Classification of furnaces. Artificial draft and blast. Electric furnaces. Reference books: Hofman's *General Metallurgy*. Second Edition; Fulton's *Principles of Metallurgy*. Second term (2).

245. METALLURGY OF IRON. Chemical and physical properties of iron. Iron ores. Preparation of ores. The blast furnace. The mixer. Remelting. Refining. Puddling. The Bessemer process. The open hearth process. Duplex process. Cementa-

tion. Manufacture of crucible steel. Electric Steel. Alloy steels. Direct processes. Casting, forging and heat treatment. Reference books. Ledebur's *Eisenhüttenkunde*. Stoughton's *Metallurgy of Iron and Steel*. Second term (2).

246. METALLURGICAL PROBLEMS. A course of problems embodying the use of the physical, chemical and mechanical principles as the basis of practical metallurgy. Data taken from actual practice, so that the results have an important bearing in the understanding of metallurgical processes. References: Richards' *Metallurgical Calculations*, Parts I and II. Second term (1).

247. GENERAL METALLURGY. Shorter course. Reference books: Fulton's *Principles of Metallurgy*, Hofman's *General Metallurgy*. First term (1) or second term (1).

248. METALLURGY OF IRON, STEEL AND OTHER METALS. A shorter course. Reference books: Stoughton's *Metallurgy of Iron and Steel*. Gowland's *Metallurgy of Non-Ferrous Metals*. First term (1) or second term (1).

249. METALLURGICAL PROBLEMS. A course of problems embodying the use of physical, chemical and mechanical principles utilized in practical metallurgy, particular attention being paid to the needs of the civil, mechanical and electrical engineer. Richards' *Metallurgical Calculations*, Parts I and II. First term (1) or second term (1).

Courses 247, 248 and 249 are an abridgement of courses 245, 246, 247 and 251, for students of Civil, Mechanical and Electrical Engineering, Ship Construction and Marine Transportation.

250. MECHANICAL AND HEAT TREATMENT OF STEEL. A brief course in the mechanical working heat treatment and metallography of iron and steel, for students of Mechanical Engineering. First term (3).

251. METALLURGY OF COPPER, LEAD, SILVER, GOLD, ZINC, TIN, MERCURY, NICKEL, ALUMINIUM, ETC. COPPER: Chemical and physical properties. Ores. Smelting sulphide ores. The Bessemer process. Treatment of oxide ores. Wet process. Electrolytic processes. LEAD: Chemical and physical properties. Ores. Smelting processes. Condensation of lead fume. Refining and desilverization of base bullion. SILVER: Chemical and physical properties. Ores. Smelting with lead. Amalgamation. Leaching processes. GOLD: Chemical and physical

properties. Ores. Gold washing. Gold milling. Chlorination. The cyanide process. Parting gold and silver. ZINC: Chemical and physical properties. Ores. Belgian and Silesian processes for the manufacture of spelter. Manufacture of zinc oxide. Electrolytic processes. MERCURY: Chemical and physical properties. Ores. Processes of extraction. ALUMINIUM: Chemical and physical properties. Ores. Extraction by electrolysis. TIN, NICKEL, PLATINUM, ANTIMONY, etc.: Chemical and physical properties; Ores; Processes of Extraction. Reference books: Schnabel's *Handbook of Metallurgy*, Gowland's *Metallurgy of the Non-Ferrous Metals*, Hofman's *Metallurgy of Copper*, Hofman's *Lead*, Collins' *Silver*, Rose's *Gold*, Ingall's *Zinc*, Richard's *Aluminium*, Louis' *Metallurgy of Tin*, Wang's *Antimony*. First term (4). For students of Mining Engineering, first term (3).

252. METALLURGICAL PROBLEMS. A course of problems concerned with the principles utilized in the metallurgy of the non-ferrous metals. Reference: Richards' *Metallurgical Calculations*, Part III. First term (1).

253. ELECTROCHEMISTRY. Lectures discussing the phenomena of electrolysis and the various theories proposed to account for them. Special consideration of secondary reactions, and also of the quantitative relations between electrical and chemical energy, and their mutual convertibility. Reference books: Le Blanc's *Text-book of Electrochemistry*. Allmand's *Applied Electrochemistry*. First term (1).

254. ELECTROMETALLURGY. Lectures discussing the practical application of electricity to metallurgical processes. Electrolytic and electric furnace plants and practise. Reference books: Borchers' *Electric Smelting and Refining*. Neuburger's *Handbuch der Praktischen Elektrometallurgie*. Second term (1).

255. ELECTROCHEMICAL LABORATORY. Quantitative relations in the deposition of metals by electrolysis. Experimental study of the conditions controlling the nature of electrolytic deposits. Electrolysis of fused salts. Cathodic and anodic reactions. Fee, \$5. First term (1).

256. METALLURGICAL LABORATORY. Calibration and use of instruments employed in metallurgical investigations, pyrometers, calorimeters, etc. Determination of specific heats, latent heats of fusion and vaporization, vapor tensions, heats of combustion, heats of chemical combination and reaction.

Heat conduction and radiation. Determination of efficiencies of furnaces. Experiments with electrochemical processes, electric furnaces, etc. Fee, \$10. Second term (2).

257. METALLOGRAPHY. The study of Metals and Alloys: their physical, chemical and microscopic properties together with deductions drawn therefrom. The influence of thermal and mechanical treatment on physical properties and structure. Lectures and laboratory work. Fee, \$10. Reference books: Gulliver's *Metallic Alloys*, Sauveur's *Metallography and Heat Treatment of Iron and Steel*. First term (2); second term (1).

258. METALLURGICAL DESIGN. The application and extension of the principles involved in courses 247 and 252 to the design of metallurgical apparatus and machinery. Second term (2).

259. METALLURGICAL FRENCH OR GERMAN. Reading of technical journals or books with the staff of the Department. Second term (1).

260. SEMINARY. A conference hour of the staff of the Department with students, to discuss current metallurgical processes and problems, and thesis work, involving some reading of current literature and other preparation on the part of the students. First term (1). Second term (1).

261. THESIS FOR DEGREE. Presentation by every student in Metallurgy of a thesis on some topic which requires original literary and other work, such as observations, calculations, or experimental tests when practicable. First term (1); second term (3).

For summer schools, see courses 350 and 413, also statement on page 134.

GEOLOGY

PROFESSOR MILLER, ASSISTANT PROFESSOR TURNER,

ASSISTANT PROFESSOR FRETZ, MR. LAWALL

266. MINERALOGY. The principles of crystallography with practice in the determination of forms on models and crystals. The physical properties, origin, occurrence, association and alteration of minerals. A study of about one hundred and fifty of the common mineral species and varieties, particularly the rock-forming minerals, with practice in identification based on association and physical properties. First term (4).

A deposit of \$5 is required from each student taking course 266, to cover damages to collections and instruments and the value of supplies furnished him. In case the damage consists only of ordinary wear and tear the amount retained to cover it is about \$3 for each student.

267. BLOWPIPE ANALYSIS. A course in qualitative blowpipe analysis and special chemical tests in which the chemical and physical behavior of all the common chemical elements and their compounds under various conditions is noted. Methods of rapid qualitative testing as a means of identifying minerals and chemical compounds with the aid of the blowpipe. Fee, \$4. First and second terms (1).

268. GENERAL GEOLOGY. A course in dynamic, structural, and historical geology. Text-book, supplemented by illustrated lectures in which the relation of geology to engineering problems is discussed. The different geologic periods and their characteristic types of life. The principles of organic evolution as shown in the development of new forms in the successive periods are treated; also a brief review of the geology of the North American continent and the physical changes which it has undergone during its development. Second term (2).

269. GEOLOGICAL LABORATORY AND FIELD TRIPS. A study, during the winter months, of the various types of rocks, to enable students to determine and classify them without a microscope. Principles of rock classification presented in a series of lectures, supplemented by laboratory practice with a petrologic collection comprising rocks gathered from all parts of the country. Attention given to the examination of the varieties of rocks used for constructional purposes with discussions of the factors which render them desirable. A series of lectures on primary and secondary rock structures, supplemented by laboratory work on the interpretation and construction of topographic and geologic maps and sections. Field trips weekly, during the spring months, to nearby localities to study rock structures and deposits of economic importance.

The region furnishes excellent examples of varied structures and contains numerous quarries where slate, cement rock, limestone, sandstone, gneiss and serpentine are obtained, all of which are visited by the classes. On such field

trips, special attention is given to the methods of geologic mapping. Second term (3), (2) or (1).

A fee of \$1 is required of each student taking course 269 to cover damage to collections and the value of supplies furnished.

270. ECONOMIC GEOLOGY. A study of the origin, modes of occurrence, properties, sources, production, and uses of the non-metallic mineral products. Comprehensive reports on various products. Preparation required: 266, 268 and 269. First term (2).

271. ECONOMIC GEOLOGY. A study of the metallic mineral products. Causes of the formation of cavities in rocks, their relation to metalliferous deposits; discussion of the theories of ore-deposition; the structure, geologic horizon, and geographic distribution of the principal metallic economic deposits of the United States. Recitations, illustrated lectures, field trips, and laboratory work. Visits, for the purpose of studying ore occurrence, to the zinc mines of Franklin Furnace, N. J., and Friedensville, Pa., the magnetic mines of Dover, N. J., and Cornwall, Pa., the limonite mines of Iron-ton, Pa., and the anthracite coal mines. Preparation by each student of a series of maps illustrating the location, production, chemistry, and geology of the economic products of the United States. Preparation required: 266, 268 and 269. Second term (4).

272. PALEONTOLOGY. An elementary course in paleontology in which the animal life of the past is considered both from the biological and geological viewpoints. Theories of origin and evolution of life; principles of stratigraphy and paleontology. Study in the laboratory of index fossils of the successive geologic periods. Preparation required: 268 and 269. Second term (3).

273. GEOLOGY OF NORTH AMERICA. The geological age and geographical distribution of the rocks of which North America is composed; the structure and history of its mountain ranges; the history of its geological development and origin; reviews of the great surveys that have been made. Lectures and laboratory work. Preparation required: 268 and 269. Second term (3).

274. PHYSIOGRAPHY. The cosmic relations of the earth; the classification of land forms; the study of their origin, growth, and decay and the factors governing their development. Study

of topographic and geologic maps. The relation of topography to geologic structure. The response of man and other organic life to an inorganic environment with special reference to the influence of physiography upon the economic development of countries. Brief study of weather and climate. Second term (2).

275. FIELD GEOLOGY. Geological maps—their use and the methods by which they are constructed. Practice in the actual working out of surface geology. Problems in plotting geology on topographic maps, each student being assigned a definite area and required to make a geological map of it with structure sections. Collection by each student of a full set of specimens to illustrate the geology.

The first part of the course is devoted exclusively to field work and the notes then taken are worked up in the laboratory when the weather prevents further out-door work. Preparation required: 268 and 269. First term (3).

A fee of \$1 is charged each student taking this course.

276. PETROGRAPHY. The optical properties of minerals and their study with the petrographic microscope. Petrography of the more important igneous rocks. Lectures, recitations and laboratory work. Preparation required: 266 and 325. First term (2).

A laboratory fee of \$3 is charged each student taking this course.

277. PHYSIOGRAPHY. A study of topographic forms and the processes that have produced them; the weather and climate; and the influence of physical conditions upon the development of countries. First term (3).

278. PHYSIOGRAPHY. A continuation of course 277. Recitations, lectures, laboratory work, and field trips. Physiographic regions of North America and Europe. Topographic maps and the preparation of weather and climate charts. Emphasis on the effect that physiographic conditions have in determining the commercial and industrial importance of nations. Second term (3).

279. MINING AND GEOLOGIC LAW. A study of the legal matters that confront a mining geologist. The law in regard to underground waters and mineral products. Preparation of abstracts of important cases, accompanied by drawings showing the

geologic conditions upon which the decisions were made. First term (1).

280. STRUCTURAL GEOLOGY. The study of special features of structural geology in the field and laboratory. First term (1).

281. GEOLOGIC METHODS. The study of methods employed by the geologist in the various lines of geologic investigation. Methods employed by the United States Geological Survey and by the mining companies that employ geologists. Special attention to the problems that confront an economic geologist in the investigation of coal lands, oil properties, metal mines, etc. Second term (3).

BIOLOGY

PROFESSOR HALL, MR. FLORY

290. BOTANY. An elementary course treating of the structure and classification of plants. Lectures, laboratory work, and reference to text-books. Preparation advantageous: 292. Second term (2).

291. FORESTRY. Lectures, recitations and laboratory work. A brief introduction to botany, followed by lectures on dendrology and text-book work on forestry. Laboratory work devoted mainly to dendrology and the characteristics of the wood of important timber species. Field trips during the autumn to enable the student to become familiar with the trees of the region. First term (3).

Careful consideration has been given by friends of the University and by the Board of Trustees to the matter of forestry in connection with the conservation of our natural resources. It does not appear to the Trustees that the present demand for professional foresters is such as to justify the establishment of a school of forestry at the University. It does appear that the question is of such great and growing importance that the University should do its part toward calling the attention not only of its students but of the section of country reached by the influence of the University to the need of a better knowledge of the principles involved. To this end courses of lectures have been instituted to which the public is invited and special instruction is given in forestry in certain of the courses.

In furtherance and support of the cause of Forestry the University has offered free tuition scholarships to graduates

of the Pennsylvania State School of Forestry at Mont Alto, to pursue, as special students at this University, courses supplementary and cognate to their studies at Mont Alto.

292. **BIOLOGY.** Lectures, recitations, and laboratory work. Lectures on the following topics: (a) fundamental conceptions; life, protoplasm, the cell, etc.; (b) the structure, development, relationships, habits, and geographic distribution of animals; (c) the more important biological theories; variation, heredity, evolution, etc. In the laboratory, types of the various phyla are dissected and drawings made. First term (3).

293. **COMPARATIVE ANATOMY OF VERTEBRATES.** Text-book work and recitations on the comparative anatomy of vertebrates, with a more extended discussion of biological theories. Laboratory work consisting of the dissection of types of the several vertebrate classes. Preparation required: 292. Second term (3).

294. **VERTEBRATE EMBRYOLOGY.** Lectures, reading and laboratory work. Study of living, preserved, and sectioned material demonstrating the successive stages of cleavage, gastrulation, and the formation of organs. Preparation required: 293. First term (3).

295. **SANITARY BIOLOGY.** Lectures, recitations, assigned reading and laboratory work. Study of bacteria; microscopical appearance, methods of staining, plate and tube culture, etc. The quantitative and qualitative bacteriological and microscopical examination of water. Second term (3).

296. **BACTERIOLOGY.** Recitations and laboratory work. General study of bacteria. Special attention to those forms which are economically important, such as those of water, foods, dairy products, soils, etc. Preparation advantageous: 290 or 292. First term (2).

297. **ADVANCED BACTERIOLOGY.** Lectures and recitations on the study of disease, immunity and sanitation. Laboratory work on the determination of species, with a special study of the pathogenic bacteria. Opportunity is given for the independent study of special problems in practical hygiene. Preparation required: 295 or 296. Second term (2). (Not offered in 1920-21.)

298. **PHYSIOLOGY.** A course in normal physiology, hygiene and sanitation aiming to give that knowledge of the body and its functions which all should have. Emphasis on the applica-

tion of such knowledge to personal hygiene and public sanitation. Second term (2).

(A fee of \$3 is required in courses 292, 295, 296, and 297, to cover the cost of material and breakage.)

HYGIENE

DR. ESTES

299. **HYGIENE.** Lectures on methods of personal hygiene and sanitary laws. For the benefit of engineering students who may later, as engineers and explorers, be charged with the health oversight of men, suggestions are given in this course regarding the physical care and sanitary comfort of working groups.

MINING ENGINEERING

PROFESSOR ECKFELDT, ASSISTANT PROFESSOR BARTLETT, MR. LARSON

300. **MECHANICAL DRAWING.** The use of instruments. Lettering and tracing. Isometric drawing. Sketches and working drawings of simple machine parts. Blue printing. **DESCRIPTIVE GEOMETRY.** Projections, intersections, and developments of cylinders, prisms, cones, etc. Application to graphical solution of mining problems. First and second terms (2).

301. **MINING ENGINEERING.** **PROSPECTING.** Modes of occurrence of minerals. Uses of geology. Prospecting for placers, veins and beds. Magnetic prospecting. Drilling, sampling. Valuation of property. Location of claims. Patenting mining ground. **BORING.** Use of bore-holes. Methods; by percussion and rotation. Special methods. Shaft sinking by boring. Survey of bore-holes. **EXPLOITATION.** Location of plant. Rock drilling; tools and machines. Explosives; blasting; safety regulations. Shaft and slope sinking; tunneling. Supporting excavations by timber, metal, masonry, or concrete. Systems of mining underground and at the surface. **HAULAGE.** Surface and underground methods. Motors and cars; wire rope, aerial tramways. Loading and unloading, storage of minerals. Transportation of workmen. Signaling. First term (4).

302. **ORE DRESSING.** General principles and physical properties upon which the recovery of minerals or metals from ores are based, followed by detailed study of machines and

apparatus used in modern practice for coarse and fine crushing; classifying and preparation for concentration; various methods of concentration, including gravity and magnetic methods, oil flotation, etc.

Application of above methods to various ores; mill schemes or flowsheets. Study of procedure followed for treatment of ores and coal in typical modern concentrating plants.

Mill location, construction, arrangement of machinery, operation, and costs. Visits to mills and anthracite breakers.

ORE DRESSING LABORATORY. Experimental work and tests on ores, giving practical application of principles and processes covered. A well equipped modern laboratory gives opportunity for individual as well as class operation of the most approved machinery for the preparation of ores. Fee, \$5. First term (3).

303. MINING ENGINEERING. HOISTING. Motors, ropes, attachments, receptacles. Safety appliances. Systems of hoisting. DRAINAGE. Surface water; prevention of access. Mine dams. Tunnel drainage. Mechanical drainage; water hoisting; pumping. Classes of pumps. VENTILATION. Atmosphere of mines. Pollution of air. Natural and mechanical methods of ventilation; systems. Types and efficiencies of ventilating machines. Instruments for testing air. Ventilation laws. LIGHTING. Methods employed. Safety lamps; electric lighting. Safety regulations. FIRST AID. Accidents; classes, causes. Means of prevention. Rescue work. Hygiene of mines; rules and laws. First Aid to injured. RAILROAD CONSTRUCTION. Earthwork, trackwork, trestles, bridges, railroad structures, water tanks, yards. Second term (4).

304. MINE SURVEYING. Instruments. Forms of notes. Outside work. Determination of meridian. Inside work. Connecting outside and inside work through shafts, slopes, or tunnels. Calculation of notes; mapping. RAILROAD SURVEYING. Preliminary and location methods; theory of curves, turnouts, etc. Care of maps. Detection of errors. Special problems. Fee, \$1. Summer term at the end of Junior year, four weeks, beginning June 15, 1921.

305. MINING ENGINEERING. CONSTRUCTION MATERIALS. The use of stone, brick, concrete, metal and wood for foundations, piling, dams, reservoirs, retaining walls, mine buildings, railroads, trestles, tipples, ore bins and docks. MINE ADMINIS-

TRATION. Organization, employment of labor, management, mine accounts, principles of mining. First term (3).

306. OIL AND GAS TECHNOLOGY. Origin and distribution of petroleum and natural gas. General survey of the geological conditions surrounding their accumulation. Oil shales. Prospecting and mapping. Location of wells. Drilling; pumping. Special methods. Storage. Pipe lines. Tank cars. Second term (2).

307. MINING DESIGN. The design of parts of mining plant to meet given conditions, with detailed working drawings, accompanied by estimates of material and costs. Second term (3).

308. PROSPECTING. Surface indications of minerals, including oil, gas and water. Geological interpretation of strata and out-crops. Prospecting on surface and underground. Boring; magnetic prospecting. Mapping. Sampling and valuation of prospects. Locating and patenting claims. This course is given as an elective for B.A. students. First term (2).

PHYSICS

PROFESSOR MAC NUTT, ASSOCIATE PROFESSOR CHARLES,
ASSISTANT PROFESSOR FREY, ASSISTANT PROFESSOR FRAM,
MR. MARTIN, MR. TAYLOR, MR. CONCILIO,
MR. NICHOLAS, MR. ZINSZER

320. ELEMENTARY MECHANICS. Statics. Lecture demonstrations and recitations. First term (3).

321. ELEMENTARY MECHANICS. Dynamics. Heat. Lecture demonstrations and recitations. Second term (3).

322. PHYSICAL MEASUREMENTS. Laboratory and lectures. Second term (1).

323. ELEMENTARY PHYSICS. Electricity and magnetism. Lecture demonstrations and recitations. First term (3).

324. PHYSICAL LABORATORY. Mechanics, heat and electricity. Pre-requisite, course 322. First term (1).

325. ELEMENTARY PHYSICS. Light and sound. Lecture demonstrations and recitations. Second term (3).

326. PHYSICAL LABORATORY. Electricity, magnetism, light and sound. Pre-requisites, courses 322, 323, 324. Second term (1).

327. ELEMENTARY PHYSICS. A brief general course. Lecture demonstrations, recitations and laboratory. First term (3). Second term (3).

328. ADVANCED THEORY OF ELECTRICITY AND MAGNETISM. Lectures and recitations. Ferro-magnetism, electro-magnetism, induced electromotive force and inductance, magnetic properties of iron, electric charge and the condenser, electric field, potential, electric oscillation and waves, electron theory, electrolysis. Pre-requisites, differential and integral calculus and course 323. First term (2).

329. ELECTRICAL LABORATORY. Precise measurements. Pre-requisites, courses 322, 323, 324, 326. First term (1).

330. ELECTRICAL LABORATORY. Precise measurements. (Continuation of 329.) Second term (1).

331. ELECTRICAL LABORATORY. Advanced experimental studies and tests. (Continuation of 330.) First term (1).

332. THEORETICAL PHYSICS. Elective courses in the theory of heat, in the theory of electricity and magnetism, and in the theory of optics. Arrangements as to topic and as to time to be devoted to it are made for each group of students who elect Theoretical Physics. First and second terms (3) to (5).

333. PHYSICAL RESEARCH. Experimental investigations in physics to be elected by special advanced students. Arrangements as to topic and as to time to be devoted to it are made for each individual student. First or second term (2) to (4).

334. PHOTOMETRY AND ILLUMINATION. Lectures and recitations. Illumination standards, measurements of light and of illumination, laboratory methods and devices, commercial methods and experiments, comparison of illuminants and illuminating devices, practical installations. First term (1).

335. GENERAL PHYSICS. A course intended primarily for students taking pre-medical studies. Pre-requisite, course 327. First term (3); second term (3).

336. THE TEACHING OF PHYSICS IN SECONDARY SCHOOLS. Principles of scientific method. A study of class room practise in neighboring schools. Text-books and methods. First term (2).

Fee of \$6 required in connection with courses 322, 324, 326, 329, 330, 331 and 333.

ELECTRICAL ENGINEERING

PROFESSOR ESTY, ASSOCIATE PROFESSOR SEYFERT,
ASSOCIATE PROFESSOR SCHEALER, ASSISTANT PROFESSOR BEAVER,
ASSISTANT PROFESSOR GRUBER, ASSISTANT PROFESSOR ESHBACH

350. CONSTRUCTIVE ELEMENTS OF ELECTRICAL APPARATUS. Studies of electrical machinery and appliances with the object of familiarizing the student with principles of operation, structural details, and practical uses. The student is supplied with a complete printed outline of the work to be done containing full instructions and explanations. The work consists of three parts, as follows: (a) Illustrated lectures, (b) inspection and sketching of electrical machines and apparatus, and (c) visits of inspection to neighboring electric light and power plants. Written reports are required on each day's work. Fee, \$3. This work is accompanied by *Constructive Elements of Machinery*, No. 201. Summer term, four weeks, beginning June 15, 1921.

351. ELECTRICAL DISTRIBUTION. Systems of direct current distribution; wiring formulas and applications; installation of electrical machinery and apparatus; interior wiring, overhead and underground construction; rules and regulations of the National Board of Fire Underwriters. Preparation required: 350. First term (2).

352. DYNAMOS AND MOTORS. Review of principles of electricity and magnetism with special reference to their application to the dynamo. The construction, operation and control of direct current machinery; practical operation and management of dynamo machines; station equipment; cost of electrical energy; electro-magnets, magnetism of iron; characteristic curves, armature windings. Illustrative problems. Preparation required: 322, 351. Second term (3).

353. DYNAMO LABORATORY. Introductory course supplementing the class work of 352. Experimental studies and tests of direct current generators, motors, and appliances, for characteristics, regulation, efficiency, insulation, etc. Fee, \$6. Preparation required: 322, 351. Second term (1).

354. DYNAMOS AND MOTORS. An abbreviated course adapted to those students who do not continue this subject in the following year; the principles and practice of direct current engineering, including: the elementary theory, construction, opera-

tion and control of direct current generators and motors, electromagnets, solenoids, automatic starters and controllers, station equipment, storage batteries. Illustrative problems. Preparation required: 332, 324. First term (2).

355. DYNAMO LABORATORY. Introductory course supplementing the class work of 354. Experimental studies and tests of direct current generators and motors for characteristics, regulation, efficiency, etc. Fee, \$6. Preparation required: 323. First and second terms (1).

356. DYNAMO LABORATORY. Continuation of 355 and supplementing the class work of 362 or 379. Advanced testing of direct current machines; practice in operating and testing alternating current apparatus. Fee, \$6. Preparation required: 355, 354. Second term (1).

357. THEORY OF ALTERNATING CURRENTS. The elementary principles of alternating currents. Lectures, recitations and problem work. Preparation required: 352, 326. First term (3).

358. DYNAMO LABORATORY. Continuation of 353. Advanced testing of direct current machines. Fee, \$6. Preparation required: 352, 353. First term (1).

359. THEORY OF ALTERNATING CURRENTS. Continuation of 357. Advanced theoretical studies of alternators, synchronous motors, and synchronous converters. Preparation required: 357. Second term (2).

360. ELECTRICAL ENGINEERING. Application of physical and mathematical principles to the analysis and solution of problems relating to direct and alternating current circuits and apparatus; transient phenomena, use of complex quantities; non-harmonic periodic wave forms. Preparation required: 328, 357. Second term (2).

361. ELECTRICAL ENGINEERING. A course particularly adapted to students who do not further specialize along electrical lines; systems of generation, transformation, distribution and transmission of electrical energy by direct and alternating currents; the application of electric motors to various industries; overhead and underground construction; estimates and costs. Preparation required: 354, 355. Second term (2).

362. DYNAMO LABORATORY. Continuation of 358. Advanced testing of direct current machines. Alternating current test-

ing begun. Fee, \$6. Preparation required: 357, 358. Second term (1).

363. ALTERNATING CURRENT MACHINERY. Study of the structural details, characteristics and operation of alternators, alternating current motors, rotary converters and transformers; application of vectors. Preparation required: 329, 359, 360. First term (4).

364. DYNAMO TESTING. Lectures on the methods of testing electrical machinery and apparatus, including direct current generators, motors and motor generator sets. Special methods of testing large machines; commercial tests as carried out by the large manufacturing companies. Preparation required: 328, 357, 358. Second term (1).

365. DYNAMO TESTING. Continuation of 364. Lectures on testing of alternating current machinery and apparatus, including generators, motors, rotary converters, transformers, induction regulators, etc. Preparation required: 359, 364. First term (1).

366. DYNAMO LABORATORY. Advanced experimental studies and tests of direct and alternating current generators and motors, synchronous converters, transformers and auxiliary apparatus; measurement of power in polyphase circuits. Fee, \$12. Preparation required: 359, 360, 362. First term (3).

367. ELECTRICAL DESIGN. Application of electric, magnetic and mechanical principles to the design of electromagnetic mechanisms, direct current generators and motors; predetermination of characteristics and performance; armature windings. Lectures, recitations, problems, drafting. Preparation required: 359, 360, 362. First term (3).

368. ELECTRIC STATIONS. Consideration of prime movers; generating machinery, discussion of types and operation; auxiliary machinery and transformers; storage batteries and their application; switch-boards, measuring and protective devices; design and arrangement; station characteristics; substations; operation and management; visits to neighboring plants. Preparation required: 355 or 356, 360 or 361. First term (2).

369. ELECTRICAL ENGINEERING SEMINARY. A weekly meeting held in the department reading room for discussion of topics from the current journals of theoretical and applied elec-

tricity. Presentation of papers on assigned topics; new inventions and discoveries critically reviewed. Preparation required: 357, 360. First term (1).

370. ELECTRICAL DESIGN. Continuation of 367. Application of electric, magnetic and mechanical principles to the design of alternating current machinery and apparatus; predetermination of characteristics and performance; armature windings. Lectures, recitations, problems, drafting. Preparation required: 363, 366, 367. Second term (2).

371. ELECTRICAL TRACTION. The construction, equipment and operation of different types of electric railways. The application of electric traction under steam railroad conditions; the dynamics of electric train movements; predeterminations of speed-time curves and the power required for different types of runs. Choice of car equipment; cost of construction and of operation. Testing of railway systems. Visits of inspection to power plants and required reports. Preparation required: 363, 368. Second term (3).

372. ELECTRIC POWER TRANSMISSION. The long distance transmission of power by electricity for use in lighting, traction, mining and manufacturing work. Mathematical determination of line constants, regulation, interference, transients, etc. Switching and protection of circuits; metering and methods of charging for power; recent practice in design and construction of lines and systems. Preparation required: 357 or 363, 360 or 361, 363. Second term (3).

373. ELECTRICAL ENGINEERING SEMINARY. Continuation of 369. Presentation and discussion of reports on thesis work. Preparation required: 369. Second term (1).

374. DYNAMO LABORATORY. Continuation of 368. Advanced alternating current testing. Fee, \$12. Preparation required: 363, 364, 366. Second term (2).

375. ALTERNATING CURRENTS. A course following course 354; the principles and practice of alternating current engineering; the theory of alternating currents with applications to alternating current generators, motors, transformers and other apparatus; systems of transmission and distribution; electric lighting. Preparation required: 354. First and second terms (2).

376. INSPECTION REPORT. During the vacation between the Junior and Senior years each student in Electrical Engineer-

ing is required to inspect some electric railway system, lighting or power plant, or other electrical installation, and prepare a written report thereon. A descriptive outline of the installation which the student proposes to inspect must be submitted to the Professor of Electrical Engineering before July 6th, and after approval the detailed report must be handed in before September 21st. These reports should contain such calculations, photographs, drawings and plots as each individual case may require.

377. **THESIS.** Until this year each candidate for the degree of Electrical Engineer was required to present a thesis upon a subject chosen by the candidate during the first term of the Senior year. At present the thesis is not required, but the candidate is allowed the choice between preparing a thesis and taking course 378 in Electrical Communication. The work upon which the thesis is based is done during the second term. It consists in part of reading from references, and in part of independent work in theory, experimental research or designing. Reports of progress in thesis work are required from time to time during the term. Second term (3).

378. **ELECTRICAL COMMUNICATION.** A survey of the methods of electrical communication, principles of various systems of wire telegraphy, wire telephony, radio telegraphy and telephony, radio laboratory measurements, radio practice of the U. S. Signal Corps. Preparation required: 357 or 375. Second term (3).

A fee of \$6 for each term-hour (period) of dynamo laboratory work taken per term is required of each student.

For Summer Schools, see courses 201, 350, 206, and 375, also statement on page 134.

CHEMISTRY

PROFESSOR ULLMANN, ASSOCIATE PROFESSOR BABASINIAN,
ASSOCIATE PROFESSOR DIEFENDERFER,
ASSOCIATE PROFESSOR CHAMBERLIN, ASSOCIATE PROFESSOR LONG,
ASSOCIATE PROFESSOR COBB, ASSISTANT PROFESSOR BECK,
ASSISTANT PROFESSOR EWING, MR. CARTER, MR. ANDERSON,
MR. BUCKLEY, MR. SMULL, MR. WARD, MR. EARLY,
MR. BARBEHENN

390. ELEMENTARY CHEMISTRY. Description of the non-metallic and metallic elements and their compounds. Lectures illustrated by experiments, diagrams, working drawings and specimens from the museum. Note-books on the lectures required. Text-book: Kahlenberg's *Outlines of Chemistry*. First term (2).

391. CHEMISTRY LABORATORY. Experiments covering a systematic study of the chemical and physical properties of the more important elements and their compounds. Text-book: Long and Chamberlin's *Experimental General Chemistry*. First term (2).

392. CHEMISTRY LABORATORY. For B.A. students. Shorter course than course 391. First term (1).

393. CHEMISTRY. A course for students who pass the examination in Elementary Chemistry held on the first Saturday of the term. Text-book: Smith's *General Chemistry for Colleges*. First term (2).

394. CHEMISTRY. Continuation of 390 and 393. Second term (1).

395. QUALITATIVE ANALYSIS. Practical work in the qualitative laboratory, accompanied by lectures and recitations. Text-book: Treadwell's *Analytical Chemistry*. Vol. I. Second term (3).

396. QUALITATIVE ANALYSIS CONFERENCE. Special consideration of science underlying qualitative analysis. Second term (1).

397. STOICHIOMETRY. Chemical problems and reactions. Text-book: Long and Salisbury's *Chemical Calculations*. Second term (1).

398. CHEMICAL PHILOSOPHY. Lecture Course, with recitations. Theories of chemistry; physical and chemical methods of determining atomic and molecular weights, thermo-chem-

istry, dissociation, solutions, catalysis, electrolysis, radioactivity, non-metallic elements and their compounds. Prerequisite: courses 390 or 393, 391, 397. Text-book: Mellor's *Modern Inorganic Chemistry*. First term (3).

399. ADVANCED CHEMISTRY. Lecture course, with recitations. Phase rule, solid solutions, colloid chemistry, metallic elements and their compounds. Prerequisite: course 398. Text-books: Mellor's *Modern Inorganic Chemistry*, Gulliver's *Metallic Alloys*. Second term (3).

400. QUANTITATIVE ANALYSIS. Practical work in the quantitative laboratory, accompanied by lectures and recitations. Acidimetry, alkalimetry, chlorimetry, and the determination and analysis of simple chemical compounds and ores. Text-book: Treadwell's *Analytical Chemistry*, Vol. II. First term (3).

401. QUANTITATIVE ANALYSIS. Shorter course. Practical work in the quantitative laboratory. Analysis of simple chemical compounds, ores and metallurgical products. First term (3).

402. QUANTITATIVE ANALYSIS CONFERENCE. Lecture and recitations concerning the laboratory work of Courses 400 and 401. First term (1).

403. QUANTITATIVE ANALYSIS. Continuation of Course 401. Second term (3).

404. QUANTITATIVE ANALYSIS. Continuation of Course 400. Analysis of minerals, ores, slags, alloys, electrolytic analysis, etc. Text-book: Treadwell's *Analytical Chemistry*, Vol. II. Second term (4).

405. QUANTITATIVE ANALYSIS CONFERENCE. Lectures and recitations concerning laboratory work of Courses 401 and 400. Second term (2) or (1).

406. QUANTITATIVE ANALYSIS. Continuation of Course 401. Ores and alloys, complete analysis of iron and steel; also gas analysis, mineral water analysis, etc. Text-books: Treadwell's *Analytical Chemistry*, Vol. II, Lord and Demorest's *Notes on Metallurgical Analysis*, Hempel's *Gas Analysis*. First term (2).

407. QUANTITATIVE ANALYSIS CONFERENCE. Discussions concerning the laboratory work of course 406. First term (2).

408. ORGANIC CHEMISTRY. Lectures and recitations. Typical compounds of carbon, their classification, general relations,

and methods of preparation of important compounds. Text-book: Bernthsen's *Organic Chemistry*, translated by Sudborough. First term (3).

409. ORGANIC CHEMISTRY. Laboratory work. Determinations of specific gravities, melting points, boiling points, vapor densities; qualitative and quantitative determinations of carbon, hydrogen, nitrogen, and the halogens. The preparation of pure organic compounds. Text-books: Gattermann-Schobor's *Practical Methods of Organic Chemistry*, Cohen's *Practical Organic Chemistry*. First term (2).

410. ORGANIC CHEMISTRY. Continuation of course 408. Lectures and recitations. Second term (4).

411. ORGANIC CHEMISTRY. Laboratory work. Continuation of course 409. Practical methods of saturation, nitration, reduction, diazotisation, sulphonation, etc. Preparation of pure compounds. Study of the properties of dyes and other commercial products. Text-book's: Gattermann-Schober's *Practical Methods of Organic Chemistry*, Cohen's *Practical Organic Chemistry*. Second term (4), (3) or (2).

412. INDUSTRIAL CHEMISTRY. Engineering fundamentals, including machinery and materials of chemical plants, transportation of gases, liquids and solids, grinding, pulverizing, screening, filtration, evaporation, distillation, etc. Laboratory work includes the application of these fundamentals, with reports on various problems of chemical engineering. First term (3).

413. ASSAYING. Lectures and laboratory practice in the furnace assay of the ores of lead, tin, gold, silver and of gold and silver bullion. Cyanidization. Calculations for slag and slag mixtures. Text-book: Lodge's *Notes on Assaying*. Summer term: four weeks.

414. ASSAYING AND INDUSTRIAL MINERALOGY. This covers much of the ground of course 413. In addition there is instruction and laboratory work in Industrial Mineralogy, embracing about 75 minerals and rocks. It is intended primarily for students in Chemical Engineering. Summer term, five weeks, beginning June 15, 1921.

415. INDUSTRIAL CHEMISTRY. Continuation of 412. Lectures, problems and inspection trips on chemical processes and industries. Second term (3).

416. INDUSTRIAL ANALYSIS. Analysis of commercial products. Laboratory work. Text-book: Allen's *Commercial Organic Chemistry*. Second term (3).

417. INDUSTRIAL ANALYSIS CONFERENCE. Lectures concerning the laboratory work of Course 413. Second term (1).

418. SANITARY CHEMISTRY LABORATORY. Qualitative and quantitative examination of drinking water and food-stuffs. Second term (2).

419. PHYSICAL CHEMISTRY. Lectures and recitations. Text-book: Lewis' *A System of Physical Chemistry*. First term (3).

420. PHYSICAL CHEMISTRY LABORATORY. Physico-chemical measurements. Text-book: Findlay's *Practical Physical Chemistry*. First term (1).

421. PHYSICAL CHEMISTRY. Continuation of 419. Second term (2).

422. PHYSICAL CHEMISTRY LABORATORY. Continuation of 419. Second term (1).

423. RESEARCH CHEMISTRY LABORATORY. Investigation approved by the Professor of Chemistry of some novel problem, involving exhaustive laboratory and library study. Second term (2).

424. HISTORY OF CHEMISTRY. Chronological development of the science, with assigned reading. Second term (1).

Deposits to cover breakage, chemicals, etc., are required as follows: Ten dollars each in courses 416 and 420; fifteen dollars in courses 391, 392, 418 and 423; twenty dollars in course 409; twenty-five dollars in courses 395, 401, 406 and 412; thirty dollars each in courses 400, 403, 404, 413 and 414; forty dollars in course 411. The unused portion of the deposit is returned to the student.

SUMMER SCHOOLS. Courses in Qualitative Analysis and Stoichiometry begin July 13, 1921, and continue four weeks. The course in Quantitative Analysis begins on the same date and continues for five weeks. The required course in Assaying and Industrial Mineralogy (414) begins June 15, 1921, and a second course may be given later. They are open to all persons prepared to take them.

SHIP CONSTRUCTION AND MARINE TRANSPORTATION

PROFESSOR FOGG, PROFESSOR CHAPMAN,
ASSISTANT PROFESSOR BECKER

450. SHIP CONSTRUCTION. One recitation and two drawing periods a week. A study of the construction of modern steel ships. The class-room work is paralleled by drawing-room exercises where the student works up a number of construction drawings based on the rules of the Registration Societies. Full treatment is given to both longitudinal and transverse types of construction. First term (3).

451. SHIP CONSTRUCTION. A continuation of course 450, which takes up details of ship construction, bow and stern construction, and special types of construction. During the courses 450 and 451 the student fairs a set of ship's lines and cuts a model. Second term (2).

452. NAVAL ARCHITECTURE. Displacement, stability, trim and launching. The class-room work is paralleled by calculations in the drawing room. A displacement sheet is worked up, a curve of stability calculated by the use of the integrator, and launching calculations carried out. Second term (2).

453. NAVAL ARCHITECTURE. Resistance, powering and propulsion of ships. The major part of this course is devoted to the speed and power of ships: the effect of size form and coefficients on speed; appendage resistance; models and model tanks. The use of model tank and trial data for the powering of ships is given full treatment. A study is made of propellers and the influence of the hull on the action of the propeller. Preparation required: 452. First term (3).

454. NAVAL ARCHITECTURE. Strength of ships, steering and maneuvering, freeboard and subdivision. A rigid treatment is given to the longitudinal stresses acting on a ship in a sea-way and is paralleled by calculations of longitudinal strength in the course in ship design. The legal requirements of freeboard and bulkhead subdivisions are taken up in some detail and the class-room work is applied to the problem in the course in ship design. Preparation required: 453. First term (2).

455. MARINE ENGINEERING. The marine power plant and the layout of machinery on shipboard. Boilers, reciprocating steam engines, turbines, combination machinery and Diesel engines; fuels, combustion, draft and draft apparatus; con-

densing apparatus and ship auxiliaries. Preparation required: 225. Second term (3).

456. STRUCTURAL STEEL DESIGN. A study of the stresses acting on steel structures, with special attention to the local stresses in a ship's structure; the design of cranes, warehouses and other steel structures. Solution of problems by graphic methods. Preparation required: 167. First term (4).

457. SHIP DESIGN. Lectures and drawing-room work. In this course and course 458 each student carries through a design for assigned requirements which parallels the classroom work. In this design he works up the dimensions, coefficients, displacement, estimated weights and lines; stability under various conditions of loading; power and propeller requirements; freeboard and bulkhead subdivisions as required by law; strength calculation; and cargo handling arrangements. The lectures also cover the design of boats for inland water navigation. Preparation required: 450, 453, 455. First term (3).

458. SHIP DESIGN. A completion of the work of course 457. The lectures in this course also cover the principles of heating, ventilation and refrigeration and some of the economic aspects of ship design and operation. Preparation required: 457. Second term (4).

459. SHIPYARD PLANTS AND TERMINAL FACILITIES. A study of the methods of constructing ships; shipyard layouts and management. This is followed by a study of the loading and unloading of ships, cranes, piers, transit sheds, warehouses and railroad facilities and the other factors involving a quick "turn around" of a ship in port. Lectures, conferences and inspection trips. Second term (3).

SUMMER WORK IN SHIP CONSTRUCTION AND MARINE TRANSPORTATION

During the summer following the Sophomore and Junior years students are required to spend at least eight weeks in a shipyard or at sea.

MILITARY SCIENCE AND TACTICS

PROFESSOR LANG, ASSISTANT PROFESSOR SHAMOTULSKI,
LIEUTENANT GRAHAM

A unit of the Reserve Officers' Training Corps was established at Lehigh University in September, 1919, under the pro-

visions of General Orders No. 49 and Special Regulations No. 44 of the War Department. Conducted on a voluntary basis during the year 1919-1920, the unit had a membership of more than 300 students and the work was highly successful. The Trustees and Faculty of the University, being convinced of the educational value of military training, made military science and tactics a required subject, under the R. O. T. C. regulations, for Freshmen physically fit entering in September, 1920, and thereafter. Provision for this training is made in their schedules of study.

The enrollment in the unit for 1920-1921 is 587. Instruction is given by three Army officers and three sergeants detailed by the War Department.

The military courses contemplated under the War Department regulations consist of two years of basic work and two years of elective advanced work along specialized lines. A student taking the courses for four years becomes eligible, upon graduation, for a commission in the Officers' Reserve Corps of the United States Army.

470. BASIC COURSE. Fundamental military training common to all arms of the service. Three hours a week, two theoretical and one practical. Theoretical instruction consists of lectures, recitations, and quizzes on organization, military courtesy and discipline, infantry drill regulations, care and handling of arms and equipment, small arms firing, interior guard duty, sanitation, first aid, personal and general hygiene, minor tactics, morale, and physical training. Practical instruction given in infantry drill, bayonet exercises, target practice, physical drill, ceremonies, and field problems in minor tactics. First and second terms ($2\frac{1}{2}$).

471. BASIC COURSE. Second year. Three hours a week fundamental military training common to all arms and liaison, sketching, map reading, signaling. Fundamentals of leadership, automatic rifle, machine guns, minor tactics. First and second terms ($2\frac{1}{2}$).

472. INFANTRY SPECIAL. Third year. Five hours a week. Drill, hand and rifle grenades, 37 m/m guns, light (Stokes) mortars, marches, care and handling of equipment, small arms firing, gallery practice, coaching, automatic rifles, rifle grenades, bridge construction, explosives and demolitions, concealment and camouflage, trenches, obstacles, orders and

messages, military courtesy and discipline, minor tactics, map manoeuvres, tactical walks, war game, administration. First and second terms ($4\frac{1}{2}$).

473. INFANTRY SPECIAL. Fourth year. Five hours a week. Infantry drill, military history and policy of the United States military law and rules of land warfare, minor tactics, map manoeuvres, tactical walks, war game, administration, musketry. First and second terms ($4\frac{1}{2}$).

PHYSICAL EDUCATION

PROFESSOR REITER, MR. BARTLETT, MR. KANALY

The aim of the Department of Physical Education is to insure the health and physical development of every student of the University. Exceptional facilities for accomplishing this aim are afforded in Taylor Gymnasium, field house and the two playing levels of Taylor Field.

Each student, upon entering the University, is given a physical examination by the Department and also a medical examination by the consulting physician. He receives a plotted card showing his relation to the normal student and he is advised as to postural and physical defects. A second physical examination later is offered, to afford evidence of improved condition.

All students are required to take regular exercise under Department supervision. This requirement calls for two hours a week in the gymnasium, or participation, under the oversight of the Director, in one of the following organized sports: football, basketball, wrestling, swimming, soccer, lacrosse, tennis and baseball. Members of the R. O. T. C. unit may substitute one hour of military drill for one of the two hours of required gymnasium.

500. GYMNASIUM. Class exercises in the open air, consisting of setting-up work for correct carriage. Work with dumb bells, wands, and Indian clubs to stimulate circulation, respiration, muscular action and to produce co-ordination and grace. Squad work on the heavy apparatus to develop strength in the larger muscles; recreative work in games and competitive exercises, to develop the play and combative elements. Stress is laid upon athletic dancing. The various drills and athletic dances are accompanied by music. Instruction is given in boxing, wrestling and swimming. The swimming course includes the various swimming strokes,

fancy diving and modern methods of life saving. A competent instructor is in charge. The measure of proficiency required of every student is swimming at least the length of the pool. Classes in the modern dances are held twice a week during part of the winter. There are voluntary classes in advanced apparatus work. Talks are given to the Freshmen on personal hygiene and the physiology of exercise. First and second terms; for Freshmen, Sophomores, Juniors, Seniors, Graduate Students, (1).

501. FIRST AID TO THE INJURED. A course designed to give the student a practical knowledge of the most efficient methods of giving first aid to the injured. A brief resume of the important points in anatomy, followed by consideration of shock, dislocation, fractures, rabies, hemorrhage, burns, sunstroke, frost bite, electricity and lightning stroke, poisons and their antidotes, drowning, asphyxiation, railroad and mining injuries. Students are required to do practical work in bandaging, applying splints and tourniquets, and to become familiar with the ordinary first aid materials and methods of transporting the injured. Second term (1).

CONFERENCE DEPARTMENT

PROFESSOR LAMBERT,

PROFESSOR PALMER, PROFESSOR ULLMANN, PROFESSOR MACNUTT

The Conference Department provides extra instruction in Mathematics, Modern Languages, Physics, and Chemistry for Freshmen and Sophomores.

Any student who wishes to clear up some difficulty in the Mathematics, Modern Languages, Physics, or Chemistry of the Freshman or Sophomore year, should consult the teachers in the Conference Department.

Students may report at 7 o'clock any evening except Saturday.

There is no fee for instruction in the Conference Department.

EXTENSION COURSES

During the year 1920-21, the extension courses of the University have been of two kinds:

1. Courses not of collegiate grade given in the Lehigh Evening School, which is also the practice school of the Department of Philosophy and Education. These include courses in

Mathematics, Mechanical Drawing, Blue Print Reading, Machine Design, Applied Electricity and Metallurgy.

2. Courses certified to be of collegiate grade. Below is the list of such courses offered. All courses marked "G" may be offered by graduate students toward the higher degrees; courses marked "g" may be so offered under conditions prescribed by the department offering the course, and with the express consent of the Committee on Higher Degrees. The letter "e" is used to indicate courses that are open to students not matriculated in the University.

PHILOSOPHY, PSYCHOLOGY AND EDUCATION

PROFESSOR HUGHES, ASSISTANT PROFESSOR DROWN,

PHILOSOPHY. 1eg. HISTORY OF PHILOSOPHY. Leighton. (2) Evenings or Saturday.

PHILOSOPHY. 2e. THE RELIGION OF PHILOSOPHY. Plato, Spinoza, Kant, James. (2) Evenings.

PHILOSOPHY. 3e. ELEMENTARY LOGIC. Sellers. (2) Saturday A.M.

PHILOSOPHY. 4e. HISTORY OF SCIENCE. Libby. (2) Evenings.

PSYCHOLOGY. 1e. GENERAL PSYCHOLOGY. (2, 3 or 4) Afternoons.

PSYCHOLOGY. 2e. INTELLIGENCE. An introductory course in testing and developing intelligence. Dewey, Terman. (2) Evenings or Saturday.

PSYCHOLOGY. 3eg. INTELLIGENCE OF SCHOOL CHILDREN. Advanced course in tests, surveys and clinical studies. (2) Evenings or Saturdays.

PSYCHOLOGY. 4eg. SOCIAL PSYCHOLOGY. MacDougall, Wallas. (2) Evenings or Saturday.

PSYCHOLOGY. 5e. MENTAL HYGIENE. Principles of psychology and psychiatry applied to increasing efficiency and happiness of children and adults. James, Hall, White. (2) Evenings.

PSYCHOLOGY. 6e. CHILDHOOD AND YOUTH. Norsworthy and Hall. (2) Evenings.

EDUCATION. 1e. ELEMENTARY SCHOOL METHODS. (2) Evenings or afternoons.

EDUCATION. 2e. EDUCATIONAL MEASUREMENTS. The standard tests of achievement; how to use them. (2) Evenings or afternoons.

EDUCATION. 3eg. EDUCATIONAL MEASUREMENTS. Advanced course. Investigations and reports. (2, 3 or 4) Evenings, afternoons or Saturday.

EDUCATION. 4eg. THE PROJECT METHOD. Readings, reports, observation, experiment. (2 or 3) Evenings.

EDUCATION. 5eg. SECONDARY EDUCATION. Introductory course. Colvin. (2) Evenings.

EDUCATION. 6eG. SECONDARY EDUCATION. Advanced course. Inglis, Monroe, Johnston. (2, 3 or 4) Evenings.

EDUCATION. 7eg. JUNIOR HIGH SCHOOL. Briggs, Douglas, and others. (2 or 3) Evenings.

EDUCATION. 8eg. SCHOOL ADMINISTRATION. Cubberly; State (2): City (2) Evenings or Saturday.

EDUCATION. 9eG. SEMINAR IN EDUCATION. Reports and discussions. Saturday.

EDUCATION. 10e. HISTORY OF EDUCATION. *Athens, the Renaissance*, Rousseau; American Schools, schools of today and of tomorrow (3) Saturday or evenings.

ECONOMICS, PUBLIC LAW AND HISTORY

PROFESSOR STEWART, MR. MAC GREGOR

ECONOMICS. 1eg. SOCIOLOGY. Sociological and economic theory, and problems to which this theory may be applied.

HISTORY. 1e. INDUSTRIAL HISTORY of the United States. *Economic History of the United States*, Bogart; *Outline of Industrial History*, Cressy. (2) Saturday.

HISTORY. 2eg. POLITICAL AND SOCIAL HISTORY of Modern Europe. Lectures and discussions. Special reference to the causes of the recent war. (2) Evenings.

LATIN

PROFESSOR BLAKE

LATIN. 1e. A course corresponding to the work of the Freshman year in college. (2), (3) or (4). Evenings or Saturday A.M.

LATIN. 2eg. Advanced course in Latin Literature, suited to graduate students. Hour to be arranged.

FRENCH

PROFESSOR FOX, ASSISTANT PROFESSOR TOOHY

FRENCH. 1e. ELEMENTARY FRENCH. (3) Evenings or Saturday A.M.

FRENCH. 2e. ELEMENTARY FRENCH, continued. Reading and conversation course. (3) Evenings or Saturday A.M.

FRENCH. 3eG. RECENT FRENCH LITERATURE. Investigation and discussion of phases of French life as exemplified in French literature; rapid reading. (3) Tuesday, Thursday, Friday, 3:30 to 6 P.M.

SPANISH

PROFESSOR FOX, ASSISTANT PROFESSOR TOOHEY

SPANISH. 1e. ELEMENTARY SPANISH. (3) Saturday A.M., or Tuesday, Thursday, Friday, 4:30 to 6 P.M.

SPANISH. 2e. ELEMENTARY SPANISH, continued. (3) Saturday A.M., or Tuesday, Thursday and Friday, 4:30 to 6 P.M.

GERMAN

PROFESSOR PALMER, ASSISTANT PROFESSOR MORE

GERMAN. 1e. ELEMENTARY GERMAN. German Grammar and Composition. Easy German Texts. (2) Saturday A.M.

GERMAN. 2e. INTERMEDIATE GERMAN. German Prose and Poetry. Heine, Keller, Meyer, Freytag, Storm, Heyse. (3) Saturday A.M.

GERMAN. 3e. Goethe's *Faust*, Part I, Lectures and Composition; or Nineteenth Century German Drama. (3) Saturday A.M.

GERMAN. 4eG. Goethe's Dramas, or Schiller's Life and Work, or Middle High German. (3) or (5) Afternoons, 4 to 6.

GERMAN. 5e. Teachers' Course in methods of teaching, discussion of text-books, phonetics of German, advanced German grammar and syntax, advanced composition. (2) Saturdays or afternoons.

ENGLISH

PROFESSOR THAYER, PROFESSOR LUCH,

ASSISTANT PROFESSOR MESCHTER, ASSISTANT PROFESSOR WALTERS

ENGLISH. 1e. PUBLIC SPEAKING.

ENGLISH. 2e. CONTEMPORARY DRAMA.

ENGLISH. 3e. VICTORIAN LITERATURE.

ENGLISH. 4e. RHETORIC AND COMPOSITION.

ENGLISH. 5e. SHAKESPEAREAN DRAMA.

MECHANICAL DRAWING

PROFESSOR LARKIN, ASSISTANT PROFESSOR QUAST

These classes meet twice a week, commencing Monday, September 27, 1920, on the top floor of Williams Hall.

The fee for Mechanical Drawing is \$5.00 for a course of 60 hours, and for Machine Design is \$10.00 for a course of 40 hours.

METALLURGY

PROFESSOR RICHARDS, ASSISTANT PROFESSOR ROUSH, MR. BUTTS

METALLURGY. 1e. GENERAL METALLURGY. (2) Evenings.

METALLURGY. 2e. METALLURGY OF IRON AND STEEL. (2) Evenings.

GEOLOGY

PROFESSOR MILLER, ASSISTANT PROFESSOR TURNER

GEOLOGY. 1e. GENERAL GEOLOGY. Lectures, field trips and laboratory. Study of geologic processes and results. (4) Saturday P.M.

GEOLOGY. 2e. GEOLOGY OF PENNSYLVANIA. Lectures, field trips and laboratory. Geological history of the State and its bearing on economic and political development. (4) Saturday P.M.

GEOLOGY. 3e. APPLICATIONS OF GEOLOGY to the teaching of Physical Geography. Illustrated lectures; discussion of school problems. (4) Evenings.

GEOLOGY. 4eG. The graduate courses listed on page 134 may be pursued as extension courses by qualified students.

BIOLOGY

PROFESSOR HALL, MR. FLODY

BIOLOGY. 1eg. GENERAL BIOLOGY. Lectures, laboratory and discussions. (2), (3), (4) Saturday P.M.

BIOLOGY. 2eg. COMPARATIVE ANATOMY. Lectures, laboratory and discussions. (2), (3), (4) Saturday P.M.

BIOLOGY. 3eg. BACTERIOLOGY AND SANITARY BIOLOGY. Lectures, laboratory and discussions. (2), (3), (4) Saturday P.M.

BIOLOGY. 4eg. EMBRYOLOGY. Lectures, laboratory and discussions. (2), (3), (4) Saturday P.M.

BIOLOGY. 5eg. The graduate course listed on page 136 may be pursued as an extension course by qualified students. Afternoons, 4 to 6, or Saturdays.

BIOLOGY. 6eg. FORESTRY. Lectures, laboratory and discussion. (3) Saturday P.M.

PHYSICS

PROFESSOR MAC NUTT, ASSOCIATE PROFESSOR CHARLES,
ASSISTANT PROFESSOR FRY, ASSISTANT PROFESSOR FRAM

PHYSICS. 1e. ELEMENTARY PHYSICS. A brief general course; lectures, demonstrations, recitations and laboratory. (4) Saturday P.M.

ELECTRICAL ENGINEERING

PROFESSOR ESTY, ASSOCIATE PROFESSOR SEYFERT,
ASSISTANT PROFESSOR BEAVER, ASSISTANT PROFESSOR GRUBER

CONSTRUCTIVE ELEMENTS OF ELECTRICAL APPARATUS. 1e. Studies of electrical machinery and appliances with the object of familiarizing the student with principles of operation, structural details, and practical uses. (2) Evenings.

ELECTROTECHNOLOGY. 2e. Review of the principles of electricity and magnetism, with special reference to their application to dynamo electric machinery; the elementary theory of direct current generators and motors; automatic starters and controllers; rates and costs; practical operation of dynamos; station equipment; storage batteries. DYNAMO LABORATORY. Experimental studies and tests of direct current generators and motors for characteristics, regulation efficiency, etc. Laboratory fee, \$6, in addition to a charge of \$15 for the course. (3) Evenings.

ELECTROTECHNOLOGY. 3e. Theory of alternating currents with applications to alternating current machinery and alternating current systems of transmissions, distribution and utilization; electric lighting. DYNAMO LABORATORY. Experimental studies and tests of alternating current generators and motors, synchronous converters, transformers, and auxiliary apparatus; measurement of power in polyphase circuits. Laboratory fee, \$6., in addition to a charge of \$15 for the course. (3) Evenings.

CHEMISTRY

PROFESSOR ULLMANN, ASSOCIATE PROFESSOR BABASINIAN

CHEMISTRY. 1e. ELEMENTARY CHEMISTRY, with laboratory. (2) or (4). Laboratory fee of \$10, in addition to a charge of \$10 for the single and \$20 for the double course. A summer course only.

CHEMISTRY. 2e. ORGANIC CHEMISTRY. (2 to 4) Fee, \$25, including laboratory. (3) or (4) Afternoon.

SUMMER SESSION, 1921

A summer session of the extension courses will open Tuesday, July 5, 1921, and continue for six weeks. Dormitories will be available at reasonable rates, for women in the Moravian College for Women, Bethlehem, and for men at the University.

In Psychology, special attention will be paid to mental diagnosis. In Education, there will be demonstration classes in elementary school subjects and in special classes, especially for supernormal children.

All courses in the Department of Philosophy, Psychology and Education are offered, and also the following: ENGLISH, 1e to 4e; FRENCH, 1e, 2e; METALLURGY, 1e, 2e; PHYSICS, 1e; PHYSICAL EDUCATION, gymnastics, swimming; GERMAN, 1e to 5e; GEOLOGY, 1e; CHEMISTRY, 1e.

A circular dealing with the Summer Session may be obtained by addressing the Registrar of the University.

EVENING SCHOOL OF BUSINESS ADMINISTRATION

The Lehigh University Evening School of Business Administration was organized in the fall of 1920 for business men in the vicinity of the University who desire a knowledge of the fundamental principles of the economics of business. A three year course is offered. Instruction is given three evenings a week, from 7:40 to 9:40 o'clock, by members of the teaching staff of the College of Business Administration.

Upon completing the course a student receives a certificate of proficiency. If he later enters the College of Business Administration, his Evening School credits will be accepted on an hour for hour basis.

The subjects of the Evening School of Business Administration are as follows:

First Year

BUSINESS LAW 1. Contracts and Negotiable Instruments.

The principles of contract; formation of contracts; operation and discharge of contracts; sales of goods; insurance contracts; principal and agent; master and servant; negotiable instruments.

BANKING AND CURRENCY. A study of the banking system of the United States, comparing it with those of the important European states, together with a study of the currency and currency problems of this country. Special emphasis upon the Federal Reserve Act.

ACCOUNTING. A study of the fundamental principles of accounting with sufficient practise work to illustrate these principles. Theories of debit and credit; single and double entry; construction of accounts; special books; distinction between capital and revenue and the problems involved; construction and analysis of financial statements; equity accounts; valuation of assets; methods and problems of depreciation. Emphasis on the economic aspects of accounting.

ECONOMICS. Lectures on economics, supplementing the other work of the school; optional.

Second Year

BUSINESS FINANCE (2 Years). An exposition of the essential principles of sound financing; the different forms of financial organization; stocks and bonds; sale of securities, promotion and underwriting; financial management and irregularities and mismanagement.

CORPORATION LAW. Formation, management, dissolution, merger and consolidation of corporations. Rights, powers and liabilities of stockholders, directors and officers. General principles of contract law applied to corporate questions.

CORPORATION ACCOUNTING. The application of accounting principles to corporations, corporation accounts and records. The voucher system; construction and analysis of corporation statements and reports; assets of corporations and their valuation; capital stock and the stock books; bonds and other forms of indebtedness; distribution of profits; handling surplus and reserves; sinking and other funds; liquidation of a corporation; combinations and consolidations; branch house accounting. Considerable practise work. Problems selected largely from examinations for Certified Public Accountancy.

Third Year.

(Three subjects to be chosen.)

AUDITING.	GOVERNMENT REGULATION OF
MANUFACTURING ACCOUNTS.	BUSINESS.
INDUSTRIAL ADMINISTRATION.	ADVERTISING.
ECONOMICS.	FOREIGN TRADE.
LAW.	INSURANCE.
INVESTMENTS.	

A circular giving entrance requirements, fees and other details may be obtained by addressing the Registrar of Lehigh University.

EVENING COURSES IN NAVAL ARCHITECTURE

In response to requests from members of the technical and drafting departments of the Bethlehem Ship Building Corporation, whose main office building is near the campus, Lehigh University in the fall of 1920 instituted Evening Courses in Naval Architecture and Marine Engineering. For the current year the work offered includes three collegiate courses: Elements of Naval Architecture, Elements of Strength of Materials, and Elements of Steam Power. The latter two will furnish the basis for a course in Marine Engine Design, planned for 1921-1922. Instruction is given three evenings a week, from 7:30 to 9:30 o'clock, by teachers of the College of Engineering of the University.

The contents of the courses now being given are as follows:

ELEMENTS OF NAVAL ARCHITECTURE: Areas and centers of gravity of areas; Simpson and trapezoidal rule; displacement and center of buoyancy calculations; displacement sheet; use of the integrator in calculating displacement and vertical center of buoyancy; transverse metacentric height; inclining experiments; trim; displacement and other curves; launching calculation.

ELEMENTS OF STEAM POWER: Heat power plant cycles; properties of gases and steam; steam engine operation; compounding of engines; valves and valve setting; regulation of engines; steam turbines; condensers and related apparatus; combustion and fuels; boilers and boiler auxiliaries.

ELEMENTS OF STRENGTH OF MATERIALS: Strength and weight of engineering materials; elastic limit; tensile, compressive and shearing strengths; modulus of elasticity; theory of beams; flexure of beams; investigation and design of beams; columns; torsion; design of shafts; transmission of power by shafts; combined stresses; impact and fatigue; centrifugal stresses.

SUMMER TERMS

Summer term courses are required as follows: Land and Topographic Surveying at the end of the Freshman year in the courses in Civil Engineering, Mining Engineering and Ship Construction and Marine Transportation; Constructive Elements of Machinery and of Electrical Apparatus at the end of the Freshman year in the courses in Mechanical Engineering, Metallurgy, Electrical Engineering and Chemical Engineering; Mechanical Technology at the end of the Sophomore year in the courses in Mechanical and Electrical Engineering; Assaying at the end of the Sophomore year in the courses in Metallurgy, Mining Engineering and Chemistry; Assaying and Industrial Mineralogy at the end of the Sophomore year in the course in Chemical Engineering; Engineering Laboratory at the end of the Junior year in the courses in Mechanical Engineering and Chemical Engineering; Mine and Railroad Surveying at the end of the Junior year in the course in Mining Engineering. Students may, with the approval of the heads of their Departments, substitute industrial work for summer courses. Students not connected with the University may be admitted to these courses if properly qualified.

GRADUATE COURSES

Courses leading to the degree of Master of Arts or Master of Science may, by permission of the Faculty, be pursued by any properly qualified person who has taken the Bachelor's degree or a degree in technology at any recognized college, university or technical institution. These courses require at least one year of advanced study in residence at Lehigh University in two departments (under two professors), or at least two years of such study in non-residence. Residence is construed as continuous attendance at the University and living under its jurisdiction. Permission to enroll for study in non-residence will be granted only in exceptional cases to students who possess ample facilities for study and work and usually only to students who can report periodically in person for conferences with the professors under whom they are studying.

The course of study selected must consist of at least fifteen exercises a week. Two-thirds of the work, ten hours a week, including a thesis, if required, must be chosen in one department called the major department. The work in the major department is to be selected from the list of graduate studies. About one-third of the work is to be in another department, called the minor department, and may be chosen from the list of graduate studies or from other advanced courses offered by the University. The candidate is required to satisfy each professor concerned that he is fully competent to pursue the subjects selected.

Candidates may be enrolled at any period of the college year, but preferably at the beginning of the regular terms in September and February.

The fees for instruction are \$100 a year for students in residence, and \$50 a year for students in non-residence, payable in advance (or as arranged with the Bursar's office). Fees for students in residence are payable in two instalments of \$60 and \$40 at the beginning of the first and second terms respectively. A student in residence who takes more than one year shall have returned to him a pro-rata part of his payment for the second, or other succeeding years, if he finishes in a fraction of that year. A student in non-residence shall pay

for the first two years; no fee will be required for the third year, but succeeding years, if necessary and permitted by the Faculty, shall be paid for at the rate of \$50 a year. The graduation fee of \$10 is required of all students.

After passing examinations in the assigned studies, presenting a satisfactory thesis as evidence of ability to do original work, if required by the professor concerned, and paying all required fees, the candidate will be recommended by the Faculty to the Trustees for the Master's degree appropriate to the course pursued.

Some of the University Extension Courses listed on page 125 are designated as graduate courses. As these are given late in the afternoon, or in the evening, or on Saturdays, they are especially adapted to teachers and others who are enrolled as graduates in non-residence.

The following graduate studies are now offered by the University:

MATHEMATICS AND ASTRONOMY

PRACTICAL ASTRONOMY

PROFESSOR THORNBURG, PROFESSOR OGBURN

The study of instruments and methods used in the determination of time, latitude, longitude and azimuth; practical work in the observatory, securing facility in making and reducing observations. Two terms (5).

DIFFERENTIAL EQUATIONS

PROFESSOR LAMBERT

Course in Differential Equations based on Johnson's *Differential Equations* and Byerly's *Spherical Harmonics*. Collateral reading in the University Library required. Two terms (3).

ANALYTIC MECHANICS

ASSISTANT PROFESSOR REYNOLDS

Elementary and Advanced Rigid Dynamics; Potential Functions, based on Love's *Theoretical Mechanics*; Williamson and Tarleton's *Dynamics*; and Routh's *Dynamics*. Two terms (3).

DIFFERENTIAL GEOMETRY

ASSISTANT PROFESSOR KNEBELMAN

Parametric representation of plane and skew curves and surfaces, theory of contact, curvature, differential invariants, in-

trinsic equations, trajectories, equations of Césaro, curvilinear coordinates, equations of Lamé.

Representation of one plane upon another, conformal and spherical representation, equations of Gauss and Godazzi, theory of applicability. Two terms (2).

ENGLISH

ENGLISH LITERATURE

PROFESSOR THAYER

An advanced course in branches which have not formed a part of the undergraduate work of the candidate, details to be arranged after a personal conference. Two terms (5).

ANGLO-SAXON

ASSISTANT PROFESSOR MESCHTER

Anglo-Saxon poetry and prose above the grade of undergraduate work, from both the literary and the historical points of view. Two terms (5).

ENGLISH PHILOLOGY

PROFESSOR LUCH

An advanced course in the principles of Teutonic philology as applied to the origin and development of the English language. Two terms (5).

SANSKRIT

PROFESSOR THAYER

Beginner's Course. Perry's *Primer*. Lanman's *Reader*. Whitney's *Grammar*. Two terms (5).

ECONOMICS AND HISTORY

POLITICAL ECONOMY

PROFESSOR STEWART

The rise and development of economic systems and economic thought; the scope and method of political economy. Patten's *Development of English Thought* and the works of Keynes, Cohn and Ingram on political economy are used. Two terms (5).

AMERICAN HISTORY

PROFESSOR STEWART

An examination of the influence of the economic development of the Union upon the legal and political theories incorporated in the Constitution. Two terms (5).

POLITICS

PROFESSOR STEWART

The history of the attempt to treat in a systematic way the problems of political organization. Pollock's *History of the Science of Politics* and Sidgwick's *Elements of Politics*. Two terms (5).

LATIN

PROFESSOR BLAKE

An advanced course in the Latin language and literature, arranged with each candidate individually upon application. Two terms (5).

GREEK

Advanced courses, of which the following are specimens, will be arranged upon application:

HELLENISTIC GREEK

PROFESSOR GOODWIN

Gospel of St. Mark, Acts, and selected *Epistles of the New Testament*. Thayer's *Lexicon*. Blass's *Grammar of New Testament Greek*. Patristic literature. Collateral reading. Selections from Lucian. Two terms (5).

DRAMATIC POETRY

PROFESSOR GOODWIN

Several plays of Aeschylus, Sophocles, Euripides, and Aristophanes. Aristotle's *Poetics*. Collateral reading. Two terms (5).

GREEK PHILOSOPHY

PROFESSOR GOODWIN

Plato's *Republic* and other works. Aristotle, selections. Ritter and Preller's *Historia Philosophiae Graecae*. Zeller's *History of Greek Philosophy*, and other collateral reading. Two terms (5).

ELECTRICAL ENGINEERING

THEORY OF ALTERNATING CURRENTS AND ALTERNATING
CURRENT MACHINERY

PROFESSOR ESTY

A course based upon the works of Arnold, Bedell and Crehore, Steinmetz, and Lawrence. Two terms (4).

ELECTRICAL DESIGN

PROFESSOR ESTY

A course consisting of predeterminations by calculation of the characteristics, regulation and performance of electrical machinery. Analysis and use of designing constants. Design of special machines. Two terms (3).

ELECTRIC TRACTION

PROFESSOR ESTY, ASSOCIATE PROFESSOR SEYFERT

The development of an electric railway project. Design of station and distribution system. Operating characteristics of direct and alternating current railway motors. Predetermination of motor equipment and run curves for given schedules and traffic. Choice of system. Estimates of costs. Two terms (3).

ELECTRICAL TESTING

PROFESSOR ESTY, ASSOCIATE PROFESSOR SEYFERT

Special experimental research in electrical engineering; tests of the magnetic properties of iron and steel; investigation of the series single-phase alternating current motor; leakage reactance of induction motors; regulation of alternators; polyphase testing; electric railway testing. Two terms (3).

RADIO COMMUNICATION

PROFESSOR ESTY, ASSOCIATE PROFESSOR SEYFERT,

ASSISTANT PROFESSOR ESHBACH

The theory underlying the various sending and receiving systems, and the propagation of electromagnetic waves, combined with experimental work in connection with the department's wireless equipment. Two terms (2).

METALLURGY**THERMO-CHEMISTRY AND THERMODYNAMICS OF THE METALS**

PROFESSOR RICHARDS, ASSOCIATE PROFESSOR ROUSH

A study of the melting points, vapor tensions, specific heats, and latent heats of fusion and of vaporization of the metals, from practical and theoretical viewpoints; also, of the heats of formation of compounds of the metals, and the relation of these to atomic weights and other chemical and physical properties. Lectures and laboratory work. First term (5).

THERMO-CHEMISTRY AND PHYSICS OF METALLIC ALLOYS

PROFESSOR RICHARDS, ASSOCIATE PROFESSOR ROUSH

A study of the physical and chemical properties of metallic alloys, their melting points, specific heats, latent heats of fusion, heats of formation and microscopic structures. Lectures and experimental work. Second term (5).

ELECTROMETALLURGY

PROFESSOR RICHARDS, ASSOCIATE PROFESSOR ROUSH

A study of the conditions of deposition of metals and alloys in electrolysis, electrolytic separations, formation of metallic compounds by electrolysis, energy absorption in electrolysis. Lectures and laboratory work. First term (5).

MINING ENGINEERING**METHODS OF MINING**

PROFESSOR ECKFELDT

The study of methods used in a given mining region, or in the production of a given class of mineral, with respect to conditions influencing choice of method and cost. Two terms (5).

MINING PLANT

PROFESSOR ECKFELDT

The determination of the efficiency of mining machinery of given types under varying conditions. Two terms (5).

ORE DRESSING PLANT

ASSISTANT PROFESSOR BARTLETT

The study of certain operations incident to the dressing of ores or the preparation of coal. Determination of efficiency of machines and processes. Losses in dressings. Two terms (5).

GERMAN

PROFESSOR PALMER, ASSISTANT PROFESSOR MORE

The German Drama of the Nineteenth Century. First and second terms (3).

Lessing as Dramatist and Critic. First and second terms (3).

Middle High German. Wright's *Middle High German Primer*, Bachmann's *Mittelhochdeutsches Lesebuch*, Nibelungenlied. First term (3).

Middle High German. Gudrun, Wolfram von Eschenbach, Gottfried von Strassburg, Walter von der Vogelweide. Lectures on Middle High German literature. Second term (3).

GEOLOGY

GEOLOGICAL INVESTIGATION

PROFESSOR MILLER

The investigation and study of the literature of some special geological problem. Field and laboratory work on some district; map of a limited area; an investigation of the microscopic character and general structural features of the rocks which are exposed; presentation of a thesis or dissertation embodying these results. Preparation required dependent upon the nature of the problems to be studied. Two terms (4).

ECONOMIC GEOLOGY

PROFESSOR MILLER

Advanced work in ore deposits. Study of the literature and of the theories of ore deposition, together with detailed work on the type occurrences of some of the metallic or non-metallic minerals. Thorough investigation and report on some mining district with special regard to the origin of the ores and such commercial aspects of the deposits as may depend chiefly on the geology. Preparation required: 270 or 271. Two terms (6).

PETROGRAPHY

ASSISTANT PROFESSOR TURNER

A critical study of recent advances in petrographic methods and nomenclature. Preparation of a detailed report on a selected problem. Preparation required: 266, 268, 269 and 276. Second term (3).

PHYSIOGRAPHY

PROFESSOR MILLER

The detailed study of physiographic types and processes. Conferences, reports and thesis, with work in the laboratory and field. A training in elementary physiography and general geology required as a pre-requisite. Two terms (4).

PHYSICAL CRYSTALLOGRAPHY

ASSISTANT PROFESSOR TURNER

An advanced course in the geometrical and physical properties of crystals, with special reference to the Goldschmidt methods of crystal measurement and projection. First term (4).

BIOLOGY**VERTEBRATE HISTOGENESIS AND ORGANOLGY**

PROFESSOR HALL

Lectures, reading, and laboratory work. Careful following, in the laboratory, of the development of a vertebrate, tracing of the history of the germ-layers, organs and tissues. Organology dealing with the association of tissues to form organs. Preparation required: 292, 293, 294. First term (3).

PHILOSOPHY, PSYCHOLOGY AND EDUCATION

PROFESSOR HUGHES, ASSISTANT PROFESSOR DROWN

The following undergraduate courses may count toward an advanced degree provided additional work is taken in connection with them: History of Philosophy, ancient and modern, History of Education, Educational Psychology, Principles and Practice of Teaching, and Psychological Studies. More advanced courses in Psychology, Logic, Ethics and Metaphysics, may be outlined to meet the needs of competent students.

The following is the course that commonly is followed by those who select Education as the major study: Educational Psychology, two year hours; School Administration, two year hours; Secondary Education, two year hours; Seminar in Education, with Thesis, four year hours. Most students in the field of Education find it convenient to avail themselves of the Extension Courses, which are listed on page 122.

GRADUATE COURSES

PROFESSOR HUGHES

History of Philosophy, advanced course. Two terms (2).
Seminar in Philosophy. Two terms (2).

Social Psychology. A. The relation to essential human needs of the several forms of culture—sport, art, the moral

and religious consciousness, and the spirit of science; their origin and development. One term (2). B. Psychological measurements and mental hygiene. One term (2).

Greek Education. One term (2).

ASSISTANT PROFESSOR DROWN

Educational Measurements. Investigation and reports. One term (2).

Secondary Education. Two terms (2).

School Administration. Two terms (2).

Seminar in Education. Two terms (2).

FRENCH

LITERATURE

PROFESSOR FOX, ASSISTANT PROFESSOR TOOBY

An advanced course in French Literature. The course is arranged with each candidate individually upon application. Two terms (5) or (10).

LANGUAGE

PROFESSOR FOX, ASSISTANT PROFESSOR TOOBY

A. OLD FRENCH. Grammar. Easier texts. Chanson de Roland. First or second term (2) or (3).

B. OLD FRENCH. Reading and explanation of texts. First or second term (2) or (3).

C. ROMANCE PHILOLOGY. Sound change. Word formation. First or second term (2) or (3).

D. ROMANCE PHILOLOGY. Syntax. First or second term (2) or (3).

SPANISH

LITERATURE

PROFESSOR FOX, ASSISTANT PROFESSOR TOOBY

An advanced course in Spanish Literature. First or second term (2) or (3).

LANGUAGE

PROFESSOR FOX

OLD SPANISH. Grammar. Readings. First or second term (2) or (3).

ITALIAN

PROFESSOR FOX

Dante's *Inferno*. Lectures and outside reading. First or second term (2) or (3).

CHEMISTRY

ADVANCED INDUSTRIAL CHEMISTRY

PROFESSOR ULLMANN, ASSOCIATE PROFESSOR CHAMBERLIN

Study of some industry dependent upon chemical principles and consists of experimental and analytical work in the lab—consisting of experimental and analytical work in the lab—study of the technical journals and other publications. Two terms (10).

ADVANCED ORGANIC CHEMISTRY

ASSOCIATE PROFESSOR BABASINIAN, ASSOCIATE PROFESSOR COBB

Original investigations in organic chemistry. Two terms (10).

ADVANCED ANALYTICAL CHEMISTRY

PROFESSOR ULLMANN, ASSOCIATE PROFESSOR DIFENDERFER

Study and comparison of known methods of quantitative analysis and the development of new methods. Two terms (10).

PHYSICAL CHEMISTRY

ASSISTANT PROFESSOR EWING

Original investigations in physical chemistry. Two terms (10).

PHYSICS

THEORETICAL PHYSICS

PROFESSOR MAC NUTT, ASSOCIATE PROFESSOR CHARLES

Elective courses in the following subjects: (a) The Theory of Heat, based upon Preston's *Theory of Heat*, Buckingham's *Thermodynamics*, and Nernst's *Theoretical Chemistry*; (b) The Theory of Electricity and Magnetism, based upon Maxwell's *Treatise*, J. J. Thompson's *Recent Researches*, and *Conduction of Electricity Through Gases*, and Hertz's *Electric Waves*; (c) The Theory of Light, based upon Preston's *Theory of Light*, Drude's *Theory of Light*, Wood's *Physical*

Optics, and Edser's *Light for Advanced Students*. First and second terms (3) to (5).

PHYSICAL RESEARCH

PROFESSOR MAC NUTT, ASSOCIATE PROFESSOR CHARLES

Opportunity afforded advanced students to pursue experimental investigations in physics. First and second terms (2) to (4).

CIVIL ENGINEERING

BRIDGE DESIGN

PROFESSOR FOGG

The theory of suspension and arched structures, with the preparation of general plans and estimates, and the economic comparison of different types. Two terms (4).

TESTING OF MATERIALS

PROFESSOR FOGG, ASSISTANT PROFESSOR FULLER

The properties of materials of construction, with special reference to inspection and testing. Original researches by the student in the laboratory. Detailed attention to the work on the unification of methods of testing done by the International Association for Testing Materials. Two terms (5).

RAILROAD ENGINEERING

PROFESSOR WILSON

The economic location of railroads, as influenced by probable volume of traffic and cost of operation. A course based on Wellington's treatise, with detailed discussion of special cases. Two terms (2).

SANITARY ENGINEERING

ASSISTANT PROFESSOR PAYROW

The designing of reservoirs, tanks, and pipe lines for water supply systems, and of sewers and other appurtenances for sewerage systems. Inspection of existing plants, with reports thereon. Two terms (4).

NAVAL ENGINEERING

ADVANCED SHIP DESIGN

PROFESSOR CHAPMAN

Advanced work in the design of cargo and passenger ships. The relation of size and speed of ships for the most

economical performance in service; a study from actual layouts of the relative merits of various types of propelling machinery; subdivision and flooding calculations according to the rules of the Bulkhead Committee of the Board of Trade.

The design of special types of ships and sailing yachts. Two terms (5).

THE POWERING AND PROPULSION OF SHIPS

PROFESSOR CHAPMAN

An advanced course consisting of a study of powering and propeller data and a comparison of the work of various investigators. Two terms (2).

THE STRENGTH OF SHIPS

PROFESSOR FOGG, PROFESSOR CHAPMAN

Investigation of the stresses set up in a ship's structure with particular application to special types of construction. Two terms (3).

TUITION AND OTHER FEES

The tuition fees for all students from September, 1920, are as follows: In the College of Engineering, \$300 for the year or \$180 for either term; in the College of Business Administration, \$250 for the year or \$150 for either term; in the College of Arts and Science, \$200 for the year or \$120 for either term.

The tuition for Chemistry offered in the Summer term immediately following Commencement Day is \$15; for all other subjects \$20. No charge is made for such subjects to students who have paid tuition for the previous year, provided the subjects in question are a scheduled part of the technical courses they are pursuing. A graduation fee of \$10 is paid by all candidates for a degree. A registration fee of \$10 is paid by each student yearly.

All fees are payable at the office of the Bursar in Drown Memorial Hall. Tuition fees are payable in two instalments, on the opening day of the college year in September, and on the first day of the second term in February. The first instalment is \$180, or \$150, or \$120, according to the course, and the second instalment is \$120, or \$100, or \$80, according to the course. Application may be made for a return of part of

the tuition fee when a student has formally withdrawn from the University after less than four weeks' attendance in either term, but the amount thus refunded will in no case exceed one-half of the last instalment paid.

Students who fail to pay tuition fees when due will be notified that their attendance at college exercises must be discontinued until payment is made.

EXPENSES

Books, stationery, and drawing instruments may be bought by students at low prices at the Supply Bureau in Drown Memorial Hall. For work in the laboratories, materials may be obtained from the University, students making a deposit at the opening of the term covering the value of the materials. The amounts of these deposits are given under the detailed statements of laboratory courses in the List of Studies.

The University dormitories accomodate 174 students. The charge for single rooms is \$80 a year; suites of three or four rooms rent at \$100 for each occupant.

Students may obtain table board at the College Commons. The rate is \$30 for thirty consecutive days. Numerous private householders in the city offer rooms and board at moderate charge.

Necessary expenses for the collegiate year, clothing and traveling not included, are estimated at \$500 in addition to tuition. This includes attendance at the required summer schools.

SITE

Bethlehem is situated at the junction of the Lehigh Valley, the New Jersey Central and the Philadelphia and Reading Railroads. The university buildings are about a half-mile from the station. New York is eighty-six and Philadelphia fifty-seven miles distant.

BUILDINGS AND GROUNDS

The University occupies nineteen buildings, and its grounds cover 160 acres on the north side of South Mountain, overlooking the valley of the Lehigh river and the city of Bethlehem.

PACKER HALL

Packer Hall, completed in 1869, is four stories in height, 215 feet long, and 60 feet wide. It is built of Potsdam sandstone in the English Gothic style of architecture.

The Department of Civil Engineering occupies the greater part of the first and second floors of Packer Hall. On the first floor are a lecture room, two recitation rooms, a large drawing hall, two instrument rooms, two offices and a library room. The instrument rooms contain seventeen transits, fourteen levels, a large geodetic theodolite, two plane tables and other instruments for engineering field work. In the library room is a collection of plans of engineering structures. On the second floor are two drawing-rooms, three recitation rooms, an instrument room, a blue-print room, and offices.

On the third and fourth floors are to be found the offices and recitation rooms of the Department of Mathematics and Astronomy.

The offices of the President, Vice-President, Secretary of the Faculty and Registrar are on the second floor of Packer Hall.

THE CHEMICAL AND METALLURGICAL LABORATORIES

The Chemical and Metallurgical Laboratories are contained in a fire-proof sandstone building, 259 feet in length by 44 in width, with two wings, each 62 feet in length by 42 feet in width.

In the Chemical department there are two principal stories, a basement and a topmost story given over to the laboratory for physical chemistry. The upper floor is occupied by the quantitative and the qualitative chemical laboratories. These rooms are 22 feet in height, and are well lighted and ventilated. Laboratories for research chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a smaller lecture room, a recitation room, a chemical museum, and laboratories for organic chemistry and sanitary chemistry.

In the basement is a large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis; also rooms containing the apparatus for processes in industrial chemistry, steam engine and dynamo and motor installation, air pump for pressure and vacuum filtration, etc.

The University has just completed an extension of the Chemical Laboratory. It is three stories high, in architectural conformity with the main building, and has inside dimensions of 60 feet by 37 feet. The equipment of these laboratories is of the most modern type, and every accessory to comfort and efficiency in expediting laboratory work is provided.

The Metallurgical department contains a lecture room; a museum of metallurgical collections; a laboratory provided with a spectroscope, a simple and a polarizing microscope, two Le Chatelier microscopes complete with camera; a dry laboratory provided with furnaces for solid fuel and for gas, with natural draught and with blast, electric current for electrometallurgical experiments, and a wet laboratory for ordinary analytical work. Equipment is provided for laboratory work in metallurgy, in metallography, and particularly in electrometallurgy, consisting of gas, electric current and apparatus for various kinds of experimental work. Several new pyrometers, calorimeters, and furnaces have been added to the general equipment. This department is therefore well arranged and equipped for the instruction of classes in metallurgy and electrometallurgy of the regular curriculum, to afford facilities to students for familiarizing themselves with the methods of measurement and research employed in metallurgy and electrometallurgy, and for conducting original investigation in these departments of science.

THE PHYSICAL AND ELECTRICAL LABORATORY

The Physical and Electrical Engineering Laboratory is 240 feet long, 44 to 56 feet wide, and four stories high. The halls and stairways, the photometer rooms, and all apparatus rooms are of fire-proof construction. The remainder of the building is of heavy mill construction.

On the first floor are the Advanced Electrical Laboratory and shops of the Physics Department, the Senior and Junior dynamo laboratories, the shop and research room of the Electrical Engineering Department, and a storage battery

room belonging jointly to the Departments of Physics and Electrical Engineering.

The dynamo laboratory for Senior students in the west wing is supplied with power from a 75-kilowatt rotary converter receiving current from the University power plant through two 30 kilowatt transformers. The dynamo laboratory equipment, which is being constantly increased, now includes the following apparatus: an 18-kilowatt double current generator, two direct current motor-generator units, one Lincoln variable speed motor, a 4-kilowatt Westinghouse two-phase rotary converter, a 10-kilowatt General Electric six-phase compound rotary converter, two direct connected units consisting of $7\frac{1}{2}$ -kilowatt six-phase General Electric alternators driven by 15-horse power Allis-Chalmers motors, one 20-kilowatt two- (or three-) phase alternator built by the Department, a 35-kilowatt Westinghouse single-phase alternator, a 10-kilowatt composite wound alternator driven by a 15-horse power Crocker-Wheeler motor, a pair of 3-horse power direct connected series crane motors, three motor-generator sets converting from alternating to direct current, four polyphase induction motors ranging from 2-horse power to $7\frac{1}{2}$ -horse power, three types of single-phase induction motors, two single-phase commutator motors, twenty-two transformers of from 1 to 15-kilowatts, including two 15-kilowatt Scott-connected transformers, a 5-kilowatt 66,000-volt testing transformer, a 6-light constant current transformer, a 30-ampere arc rectifier outfit complete, a General Electric oscillograph outfit, a Crane lecture room oscillograph, and a variety of instruments, including voltmeters, ammeters, watt-meters, rheostats, contact makers, frequency meters, dynamometers, condensers, and other apparatus.

The dynamo laboratory for Junior students on the first floor in the west wing contains the following apparatus: a 20-kilowatt Ferranti alternator driven by a direct current motor, two arc light machines, twenty arc lamps of various types, a Brackett cradle dynamometer, a Westinghouse two-phase rotary converter, a motor driven battery-booster set, several types of adjustable speed motors, and other motors for direct and alternating currents.

On the second floor are the offices of the Department of Physics and of Electrical Engineering, two general apparatus

rooms, a large laboratory room for Physics, a large dynamo laboratory for Sophomore students in Electrical Engineering, and an Electrical Engineering reading room. The dynamo laboratory for Sophomore students in the west wing is equipped with twenty-seven direct current machines of various types, dynamotors and several types of automatic starters and auxilliary apparatus. Apparatus exemplifying the operation of telegraph, telephone, and radio telegraph and telephone stations are here installed. The equipment in radio telegraphy and telephony includes a 250-foot antenna, 5-kilowatt transformer, oscillation transformer, quenched gap, and several sets of receiving apparatus.

On the third floor are the lecture room, apparatus rooms and photometer rooms of the Department of Physics, and lecture room, recitation rooms, apparatus room, and drawing-room of the Department of Electrical Engineering.

On the fourth floor are recitation rooms and two large laboratory rooms of the Department of Physics.

THE W. A. WILBUR ENGINEERING LABORATORY AND POWER HOUSE

The W. A. Wilbur Engineering Laboratory was erected in 1902; in 1907 the original building was doubled in size, the addition containing the new heating and lighting plant of the University. The building is of sandstone, conforming in material to the adjacent Chemical and Physical Laboratories. It is 44 feet wide by 188 feet long, one story high in the boiler room, but with a raised engine room forming a second story at either end.

The boiler equipment of the laboratory consists of two watertube boilers rated at about 100-horse power each, one of Babcock & Wilcox type, the other of Sterling make. In the heat and light plant there are three 250-horse power Sterling boilers, with room for a fourth unit of equal or greater capacity. Each section has its own set of feed pumps and other auxilliaries, in the arrangement of which special provision has been made for easily conducting performance tests. The laboratory boilers are connected to the chimney of the old boiler house, and have also an induced draft outfit. The chimney of the newer plant is of radial brick construction, 125 feet high, and a forced draft equipment is to be installed when need for increased capacity arises.

A coal-storage yard north of the building has room for a season's supply of coal, and a system of belt-conveyors and bucket-elevator is provided for receiving coal, dumping it on storage pile, and conveying it into the boiler room as needed.

The engine room of the laboratory, 50 feet long, contains a vertical triple-expansion engine of 75-horse power, a 60-horse power compound two stage Ingersoll air compressor, a small tandem-compound yacht engine, a simple Ball engine direct connected to a 25-kilowatt Crocker-Wheeler generator, and a 5-horse power De Laval steam turbine. There is also a complete set of Westinghouse airbrake apparatus, with four freight car brakes. The airbrake pump and all the other small motors, including the feed and condenser pumps, are piped to the surface condensers beneath the engine room floor. There are two large condensers of 150- and 60-horse power capacity respectively, with smaller ones for the pumps and for special experiments. Besides the various engines there is a large belt dynamometer, apparatus for testing guages, indicators, thermometers, steam calorimeters and other instruments, and for experiment on flow of steam, for testing injectors, etc. The exhaust system includes a Cochrane feed-water heater of 250-horse power capacity.

The engine room of the power house is 31 feet long, with concrete floor. The generating units now installed are of 50 and 100-kilowatt rating, and there is room for a third of larger size. Simple horizontal Ball engines are direct connected to General Electric alternating current generators, which furnish 60-cycle two-phase current at 2200 volts for transmission to the various distributing centers. An engine-driven and a motor-driven exciter, with the switchboard, complete the electrical equipment. The engines exhaust through a Cochrane heater, and the exhaust steam is discharged directly into the low-pressure system during the heating season.

A floor space 45 feet by 70 feet in the old boiler house is now used as a laboratory. It contains a 150-horse power suction gas producer for anthracite coal and apparatus for gas-power engineering and hydraulics, and for minor thermodynamic experiments with steam.

This building bears the name of Mr. W. A. Wilbur in grateful recognition of the work he had done for Lehigh University.

WILLIAMS HALL

Williams Hall was the donation of Dr. Edward H. Williams, Jr., of the Class of '75, and was so named by the Trustees of the University not only in recognition of this gift but also of Dr. Williams' long continued and important service to the University as an alumnus and as Professor of Mining and Geology.

Williams Hall is 186 feet long by 70 feet wide and covers a ground area of over 12,000 square feet. One-half of the building is devoted to the Department of Mechanical Engineering and the other half to the Departments of Geology and Biology.

In the eastern end there are recitation rooms, instructors' office, drawing-rooms, reference library, and store-rooms of the Department of Mechanical Engineering, and in the basement rooms and apparatus are provided for laboratory work in experimental mechanics and engineering physics, such as the calibration of the measuring instruments used in Mechanical Engineering, the determination of the mechanical efficiencies of hoisting and other gear, and the testing of motors. In this section there are electric motors, a water motor, a 15-horse power centrifugal pump, hoists, blocks, jacks, and dynamometers of various kinds.

In the west end the Department of Geology has on the first floor two lecture rooms, two offices, library, mineralogical museum, and laboratory of petrology and petrography. The lecture rooms contain specimens of rocks and fossils and a collection of economic minerals and ores. The main lecture room is fitted with a stereopticon for illustrated lectures. The laboratory of petrography is provided with fifteen high-grade petrographic microscopes, and study collections of rocks and minerals. The collection of rocks contains over six thousand specimens from type regions in different parts of the world. The mineralogical museum contains many valuable collections representing all the prominent mineral localities in the world. In the basement are the mineralogical laboratory, the blow-pipe laboratory, a small chemical laboratory for analytical work, and a room fitted with apparatus run by a one-horse power motor for cutting thin sections of rock. On the second floor is the paleontological museum, which contains the fossil collections. On the third floor is a room fitted as an

office and laboratory, containing a Goldschmidt's two-cycle goniometer and other apparatus for advanced work in crystallography.

On the third floor there are the drawing-room and an office of the Mining Department, also well-equipped blue-print and dark rooms and a photographic laboratory used jointly by the Departments of Mining and Geology.

The Department of Biology has its lecture room, office, reference library, laboratories, and store rooms on the second floor, and a large vivarium on the third floor. The laboratories of this Department are thoroughly equipped with collections, sections, microscopes and necessary appliances.

Two students' rooms, used by the Mining and Geological Society and by the Mechanical Engineering Society, are located in the basement.

THE FRITZ ENGINEERING LABORATORY

The late John Fritz, of Bethlehem, known as the father of the steel industry in the United States, and a member of the Board of Trustees dating from the founding of the University, gave to the University the funds for the erection and thorough equipment of an engineering laboratory. The building was designed and erected in 1910 under the personal supervision of Mr. Fritz. The building is equipped with a general testing section for testing iron and steel, a cement and concrete section, and a hydraulic section. The equipment is used by the Civil Engineering Department in connection with courses in Strength of Materials, Hydraulics, and Cement. Any student in the University who has the proper preparation may receive instruction in this laboratory.

The building is of modern steel frame construction, 94 feet wide and 115 feet long, with the main central section 65 feet in height, and two side sections of lesser height. The external walls which enclose the steel frame are of cement brick lined on the inside with red brick. A traveling crane, of 10-ton capacity, operated by electricity, commands the entire central portion of the building in which the testing of large specimens is carried on.

The general testing section is equipped with an 800,000-pound Riehle vertical screw testing machine, capable of testing columns 25 feet long or less, tensile specimens 20 feet long

or less, and transverse specimens up to lengths of 30 feet; an Olsen universal testing machine of 300,000 pounds capacity; smaller machines for ordinary tension, compression, transverse and torsion tests; a cold-bend testing machine, and a small machine shop. The hydraulic section occupies the east end of the main room and is equipped with various tanks, weirs, pumps and other apparatus for studying problems in hydraulics. The cement and concrete section has a large room for the making and testing of specimens and a room for the storage of materials.

THE ECKLEY B. COXE MINING LABORATORY

The Eckley B. Coxe Mining Laboratory is a building of dressed sandstone, 100 feet long by 75 feet deep, one story high in front with a raised floor in the rear.

The main part of the building contains the Ore Dressing Laboratory, 40 feet by 70 feet; the west wing contains a chemical laboratory, an assay room, a balance room, and a sampling laboratory; the east wing contains the office, recitation room and an instrument room. There is a locker and wash room in the basement of the east wing.

The equipment for the main laboratory, most of which was made by the Allis-Chalmers Co., consists of a gyratory crusher, rolls, screens, jigs, Huntington mill, classifiers, concentrators (tables and vanner), gravity stamps, amalgamating plates, grinding pan, and cyanide plant, with the necessary apparatus including grizzly, elevators, feeders, sand-pumps, settling tanks, zinc boxes, filter press, dryers, crawls, blocks, and electric motors. The sampling laboratory contains a small jaw crusher, a small gyratory crusher, rolls, sample grinder, a magnetic separator, and a small air compressor.

The machinery is driven by seven separate motors, and any one part or all of it can be operated at will, permitting experimental studies and tests of individual machines or groups of machines, or of an entire process, as occasion may require. The entire plant is thus flexible and enables combinations of processes in order to determine the best method to pursue in the treatment of gold and silver ores, both free milling and sulphides, by amalgamation and cyanide processes, and of lead, copper, zinc, iron ores, etc., and of coals, by coarse and fine concentration.

Owing to the prominence which flotation methods have assumed in ore concentration, a special department of the main laboratory has been equipped for this work, and four types of testing machines have been installed, together with the necessary equipment of motors, etc., for their operation.

The laboratory houses also the following equipment: large and small size Ingersoll-Rand rock drills, Stoper and Jack-hammer drills, an Ingersoll-Rand pick machine for coal mining, a Water-Leyner rock drill, a Sullivan hand-power diamond drill machine, and a Temple-Ingersoll electric-air drill. There are also a full size mine car, a section of track on steel ties, and several sets of steel mine timbers.

The laboratory has been named by the Trustees of the University "The Eckley B. Coxe Mining Laboratory" in memory of Eckley B. Coxe, who was universally recognized as a pioneer and a leader in the profession of mining engineering in this country, an active friend and valued Trustee of the University from its early days until his death. The Engineering and Mining Laboratories of Lehigh University, bearing the names of John Fritz and Eckley B. Coxe, record the friendship and close association of these two great engineers in their life-time, and their active interest in Lehigh.

CHRISTMAS HALL

Christmas Hall has historic interest as the first building of Lehigh University. It was originally a church, which was purchased from the Moravian Congregation. In the earliest years of the University it contained a chapel, lecture rooms and students' dormitory. After Packer Hall was completed in 1868, Christmas Hall and Saucon Hall were utilized as students' dormitories and mess hall up to 1885. For many years thereafter Christmas Hall was used by the Departments of Latin, Greek and Modern Languages.

The building is now largely devoted to the Department of Military Science and Tactics. There are class-rooms on the first floor, class-rooms and office on the second floor, and a lecture room and office on the third floor.

The offices of the Secretary of the American Electrochemical Society are in the west end of Christmas Hall.

SAUCON HALL

Extensive alterations to Saucon Hall were made in 1896, adapting it to the needs of the Department of English. It

contains a study and a recitation room for each instructor, a lecture hall seating 200 persons, and a large room on the ground floor which has been fitted up for the use of the literary societies, with committee rooms adjoining.

COPPÉE HALL

Coppée Hall, formerly the Gymnasium, was completely renovated in 1913 to adapt it to the needs of the Department of Arts and Science. On the first floor is a large lecture room, the office and recitation rooms of the Department of Economics and accounting rooms for instruction in Business Administration. On the second floor are the offices and recitation rooms of the Departments of Latin, Greek, German, Romance Languages, Philosophy and Education. The Psychological Laboratory, also situated on the second floor, is equipped for elementary instruction and experimentation in the psychology of sense and movement. On the third floor are the library and seminar room of the Department of Arts and Science, also a large room for a museum and art gallery.

SAYRE OBSERVATORY

By the liberality of the late Robert H. Sayre, one of the Trustees of the University, an Astronomical Observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

The Observatory contains an equatorial telescope by Alvin Clark, of six inches clear aperture and of eight feet focus; a zenith telescope, by Blunt; a superior astronomical clock, by William Bond & Son; a meridian circle; a prismatic sextant, by Pistor and Martins; and an engineer's transit and a sextant, by Buff and Buff.

Students in practical astronomy receive instruction in the use of the instruments and in observation.

The land upon which the Observatory stands, consisting of seven acres adjoining the original grant, was presented to the University by the late Charles Brodhead, of Bethlehem.

Sayre Observatory Annex

Sayre Observatory Annex contains a modern zenith telescope of four and one-half inches clear aperture equipped with electric illumination. The building and instruments were presented to the University by the late Robert H. Sayre in 1903.

Observations secured with this instrument are for the purpose of investigating the Variation of Latitude.

THE PACKER MEMORIAL CHURCH

The Packer Memorial Church, in which daily chapel exercises are held, was the munificent gift of the late Mrs. Mary Packer Cummings, daughter of the founder of the University. It was built in 1887 and is one of the largest churches in the State. During 1909-10 it was thoroughly renovated; the walls were newly frescoed, new stained glass windows put in place, and electric lights installed. These improvements were made possible by the continued generosity of the donor, Mrs. Cummings.

THE UNIVERSITY LIBRARY

The Library building was erected by the founder of the University in 1877, at a cost of \$100,000, as a memorial to his daughter, Mrs. Lucy Packer Linderman.

The building is semi-circular with a façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior there is a reading room 40 by 50 feet from which radiate book cases extending from floor to ceiling; two galleries afford access to the upper cases. Shelf room is provided for one hundred and sixty thousand volumes. One hundred and fifty thousand volumes are now upon the shelves. The list of periodicals numbers about four hundred.

The Library is open from 8 A.M. to 6 P.M., except on Sundays and holidays.

The free use of the Library, with the privilege of taking out books, is offered to students of every department on presentation of their registration cards. The use of the books and of the periodicals within the building is free to all persons. Resident graduates of the University have the full use of the Library on payment of three dollars annually. Persons pursuing systematic investigation in any study may be allowed the free use of the Library for a period not exceeding three months without fee. At the discretion of the Director, a deposit may be required when books are issued.

The Eckley B. Coxe Memorial Library

In memory of Eckley B. Coxe, who was for many years a Trustee of the University and who was profoundly interested in its welfare, Mrs. Coxe presented to the University his technical library, consisting of 7727 volumes, together with 3429 pamphlets. As the working library of a man who was remarkable as well for the breadth of his culture as for the

extent and thoroughness of his acquaintance with the whole field of applied science, this addition to the resources of the University possesses the greatest value for all professional students.

TAYLOR HALL

Taylor Hall, the gift of Mr. Andrew Carnegie, is a commodious concrete dormitory situated in the University Park, south of Packer Hall. It accommodates 137 students. There are suites of three rooms, (a study and two adjacent bed rooms,) for two occupants, and a few single rooms. The building was named Taylor Hall by Mr. Carnegie in honor of Mr. Charles L. Taylor, his former partner in business, a graduate of the University in the Class of 1876 and a Trustee of the University. The rates for the suites of rooms are \$100 a year for each occupant. The single rooms are \$80 a year.

PRICE HALL

Price Hall furnishes dormitory accomodation for thirty-four students. It is named in honor of Dr. Henry R. Price, an alumnus of the University of the Class of 1870, President of the Board of Trustees.

Applications for rooms in the dormitories should be filed with the Bursar.

DROWN MEMORIAL HALL

Drown Memorial Hall is a memorial to the late Thomas Messinger Drown, LL.D., President of the University from 1895 to 1904. The building was erected by his friends and the alumni of the University and is devoted to the social interests of the University students. It contains study, reading, conversation, and chess rooms, an assembly hall, and the offices of the Alumni Association, the Young Men's Christian Association, the college publications, the dramatic and musical organizations. It also accommodates the Supply Bureau, conducted by the University, the purpose of which is to furnish books, stationery and supplies to the students at reasonable prices. The profits of the Supply Bureau are applied to the upkeep of Drown Memorial Hall.

The office of the Bursar is in Drown Memorial Hall.

THE COLLEGE COMMONS

The Commons was erected in 1907 to furnish a place where students might obtain wholesome food at cost. There are accommodations for four hundred students. The present rates for table board are \$30 for thirty consecutive days.

TAYLOR GYMNASIUM AND FIELD HOUSE

In 1913 Mr. Charles L. Taylor, a graduate of the University of the Class of 1876 and a member of the Board of Trustees, donated to the University the funds required for the erection of a gymnasium and a field house.

Taylor Gymnasium is situated at the extreme east end of the grounds of the University, adjoining the athletic field. The building is 222 feet long by 73 feet wide. On the ground floor at the north end is located the game room, 93 by 70 feet, used for basketball and wrestling. The game-room is surrounded by a gallery for spectators. The main gymnasium floor measures 90 by 70 feet. Other rooms in Taylor Gymnasium are the offices and measuring room of the Department of Physical Education, a large trophy room, basketball and handball courts, fencing, boxing and wrestling rooms, and locker rooms with accommodations for the entire student-body.

The gymnasium is equipped with all modern appliances for recreative and corrective exercises, also with apparatus for calisthenic and other gymnastics, both for individual and for class work.

In addition to numerous hot and cold shower baths, adjoining the locker rooms is a swimming pool, 75 by 25 feet, with a depth from $4\frac{1}{2}$ to $9\frac{1}{2}$ feet. The capacity of the swimming pool is 95,000 gallons.

Adjoining the gymnasium and the stadium is the Taylor field house. It is two stories in height, and has dressing rooms, lockers and shower baths for visiting and Lehigh teams, and also rooms for medical attention to athletes.

TAYLOR FIELD

An athletic field of more than nine acres in area is provided by the University for the accommodation of students who participate in the various outdoor sports. The Stadium is located on the north side, or lower level, and provides football and baseball fields. It is surrounded by concrete stands having a seating capacity for more than 12,000 spectators. On the upper level there are practice fields for football, baseball, lacrosse and soccer, also a quarter mile track and a 220-yards straightaway, furnishing ample room for exercise by the entire student body. During the winter months a wooden outdoor running track, twelve laps to the mile is provided.

A cage with 60 by 120 feet floor space affords facilities for indoor baseball, lacrosse, and track and field sports practice.

All athletic sports are under the direction and oversight of the Professor of Physical Education, who is aided by an Athletic Committee composed of alumni and students, members of the Faculty, a member of the Board of Trustees, and the President of the University.

SAYRE PARK

A development of the mountain side of the University grounds was effected through the donation to the University in 1900 of the sum of \$100,000 by the children of the late Robert H. Sayre to be applied and used in the development of Sayre Park as a memorial to their father. Mr. Sayre was a Trustee of the University from its foundation in 1866 to his death in 1907. He acted for years as President of the Board of Trustees, and as Chairman of the Executive Committee of the Board, and his services to Lehigh were constant and great.

THE ARBORETUM

The Arboretum is a tract of about eleven acres added in 1909 to the upper end of Sayre Park. It was established by a lover of Forestry and a friend of the University as a tree nursery for the purpose of furnishing illustrative specimens of American trees, and of cultivating trees and shrubs for the beautifying of the Park. All of the more important species of North American trees are to be found in the University Park and the Arboretum. Adjoining the Arboretum a tract of seven acres has been planted with a variety of indigenous trees as an exhibition growth of tree culture.

THE UNIVERSITY MUSEUMS

The University Museums include large collections illustrating various branches of Chemistry, Metallurgy, Geology, Mineralogy, Zoölogy and Archæology.

The Metallurgical Cabinet contains specimens illustrating the various processes for obtaining the more common metals.

The Zoölogical collections include the Packer collection of recent shells and the Werner collection of American birds. The latter contains over three hundred and fifty species. In most cases, in addition to the adults, specimens in different plumages as well as the nests and eggs are represented.

The Geological and Mineralogical Museums are housed in the west end of Williams Hall, and contain the Roepper and Keim mineral collections, collections of fossils, specimens of

ore from mining districts, and extensive series of rocks which illustrate the type occurrences in different parts of the world.

The Cummings Archæological Cabinet has three thousand specimens and includes Dr. Stubb's collection of Indian relics, weapons and utensils.

UNIVERSITY LECTURES

From time to time during the University year, distinguished men in science, letters, art and business give lectures before the student body.

HONORARY SCHOLARSHIP SOCIETIES

PHI BETA KAPPA. Students in the College of Arts and Science and the College of Business Administration who up to the middle of the Senior year maintain high scholarship may be elected to membership, also a limited number of technical students whose work in philosophical, scientific, and language studies is of high grade.

TAU BETA PI. Students in the College of Engineering who up to the middle of the Junior year maintain high scholarship may be elected to membership.

SOCIETIES OF THE COLLEGE OF ENGINEERING

An adjunct of value in promoting professional spirit in the College of Engineering is furnished by the departmental societies,—volunteer organizations of students who meet monthly to present papers, to discuss engineering topics and, from time to time, to hear addresses by invited engineers and scientists of note.

The first of these organizations historically was the Chemical Society, organized in 1871. The original Engineering Society, open to all technical students of the University, was started in 1872. From 1885 to 1889 it issued quarterly numbers of *The Journal of the Engineering Society of Lehigh University*, containing contributions by members, alumni and others. Many of the papers read before this Society from 1890 to 1893 were published in the *Lehigh Quarterly* of those years.

Independent societies were formed in 1900 by students in the Departments of Civil Engineering and Mechanical Engineering. The Electrical Engineering Society, founded in 1887, was reorganized in 1901. The Mining and Geological Society began in 1904, the Metallurgical Society in 1917.

THE ARTS AND SCIENCE CLUB

The Arts and Science Club is the student society of the College of Arts and Science. It was founded in 1905, with the aim of promoting literary and cultural interests in the University. Students in all courses are eligible for membership. The programs of meetings include papers by members, discussions led by teachers in the College, and occasional talks by scholars from other institutions.

THE Y. M. C. A. OF THE UNIVERSITY

The Christian Association is a voluntary organization of the students for the promotion of the religious, moral, and social life of the University. It was organized April 18, 1890, and on October 11, 1890, united itself with the Intercollegiate Young Men's Christian Association. The movement is distinctly for and by students, all the officers, with the exception of the General Secretary, being chosen from the student-body. The General Secretary is Mr. J. Mark Frey, whose office is in Drown Memorial Hall.

PUBLIC WORSHIP

Morning prayers are held in Packer Memorial Church at 7:45 a.m. on every week day except Saturday. Attendance of students is required.

FOUNDER'S DAY

On the first Saturday of October of each year, commemorative exercises are held in honor of the founder of the University. On Saturday, October 2, 1920, the forty-first Founder's Day was celebrated. The oration of the day was delivered by the Rt. Rev. James De Wolf Perry, Bishop of Rhode Island.

UNIVERSITY SUNDAY

The University sermon is preached on the Sunday before University Day. The Rt. Rev. Wilson R. Stearly, D.D., Bishop Coadjutor of Newark, was the preacher on Sunday, June 13, 1920, in the Packer Memorial Church.

HONOR SYSTEM

The Honor system is in force at Lehigh University, having been adopted by the unanimous action of the student-body.

GRADUATING THESES

Theses, when required, are accompanied by drawings and diagrams, whenever the subjects need such illustration. The originals are kept by the University, as a part of the students'

record, for future reference, but copies may be retained by students, and may be published, permission being first obtained from the Faculty.

UNIVERSITY DAY

University Day is the close of the collegiate year. On this day graduation exercises are held at which an address is given by a representative of the Alumni Association, prizes and honors are awarded, and degrees are conferred.

The program of the exercises on June 15, 1920, was as follows:

MUSIC

PRAYER

ALUMNI ADDRESS

RAYMOND WALTERS, B.A., '07, M.A., '13

ANNOUNCEMENT OF PRIZES AND HONORS

The Wilbur Scholarship of \$200,

ERNEST PAUL GANGEWERE, of Chattanooga, Tenn.

First in rank in the Sophomore Class.

The John B. Carson Prize of \$50 for the best thesis in the Civil Engineering Department,

CHARLES FREDERICK RUFF, of Philadelphia, and

JEROME JOHN MIELDAZIS, of Shenandoah, jointly.

The Alumni Prizes of \$25, for first honor men in the Junior Class in various departments,

Civil Engineering,

EDMUND WARREN BOWDEN, of Camden, N. J.

The Wilbur Prizes of \$10 for excellence in the studies of the Sophomore year,

In Mathematics,

EDWIN LOUIS REYNOLDS, of Bethesda, Md.

In Physics,

GEORGE FREDERICK ADELBERT STUTZ, of Washington, D.C.

The Wilbur Prizes of \$15 and \$10, for excellence in the studies of the Freshman year,

In Mathematics,

First: ROBERT GAIR PFAHLER, of Wilkes-Barre.

Second: HENRY CONRAD BIEG, of Philadelphia.

In English,

CHARLES HECK MILLER, of Wilkes-Barre.

In German,

CLEMENT SOLOMON SCHIFREEN, of Catasauqua.

In French,

PHILIP HALSTEAD HARTUNG, of Newport, R. I.

The Price Prize in Freshman Composition, \$25,

WILBERT DAVID MUSCHLITZ, of Bethlehem.

SENIOR HONORS

College of Arts and Science,

First: HOWARD STOLPP BUNN, of Elkins Park.

Second: CLYDE REUBEN FLORY, of Edelman.

College of Engineering,

Civil Engineering Course,

First: CHARLES FREDERICK RUFF, of Philadelphia.

Second: HAROLD HODGKINS DEWHIRST, of Washington, D.C.

Mechanical Engineering Course,

First: JULIUS HERMAN SPALDING, of Pottsville.

Second: ROBERT JOSEPH OTT, of Bethlehem.

Metallurgical and Mining Engineering Courses:

First: WILBUR REINOEHL HECK, of Ocean Grove, N. J.

Second: AUGUST MAX KUHLMANN, of Washington, D. C.

Electrical Engineering Course,

First: JOSEPH HERMAN, of Northampton.

Second: FREDERICK GARNER MACAROW, of Hazleton.

JUNIOR HONORS

College of Arts and Science,

First: MICHAEL CORNELIUS SCHRADER, of Bethlehem.

College of Engineering,

Civil Engineering Course,

First: EDMUND WARREN BOWDEN, of Camden, N. J.

Second: CARL RICHARD BERNER, of Pottsville.

Mechanical Engineering Course,

First: SMIE KWEI CHOU, of Patung, Hupeh, China.

Second: EDWARD ADOLPH COPPERSMITH, of Egypt.

SOPHOMORE HONORS

In Mathematics,

First: ERNEST PAUL GANGEWERE, of Chattanooga, Tenn.

Second: EDWIN LOUIS REYNOLDS, of Bethesda, Md.

Third: CHUNG-FA CHEN, of Yo-Wan-Kei, Changsha, China.

In Physics,

First: GEORGE FREDERICK ADELBERT STUTZ, of Washington,
D. C.

Second: CHARLES FORBES SILSBY, of Washington, D. C.

FRESHMAN HONORS

In Mathematics,

First: ROBERT GAIR PFAHLER, of Wilkes-Barre.

Second: HENRY CONRAD BIEG, of Philadelphia.

In English,

CHARLES HECK MILLER, of Wilkes-Barre.

In German,

CLEMENT SOLOMON SCHIFREEN, of Catasauqua.

In French,

PHILIP HALSTEAD HARTUNG, of Newport, R. I.

Degrees in course were then conferred by the President of the University as follows:

MASTER OF ARTS

ARTHUR L. DE LOZIER, B.A., (<i>Ashland College</i>),	Allentown.
WILLIAM M. TINKER, B.A., (<i>Yale University</i>),	Allentown.

MASTER OF SCIENCE

JOHN EDMISTON BAUMAN, A.B., C.E., (<i>Muhlenberg College, Lehigh University</i>),	Allentown.
DALE S. CHAMBERLIN, CH.E., (<i>University of Michigan</i>),	Bethlehem.
OVID WALLACE ESHBACH, E.E., (<i>Lehigh University</i>),	Bethlehem.
JOHN G. SCHUMAKER, A.B., (<i>Muhlenberg College</i>),	Allentown.
HERBERT HOMER WENTZ, B.S., (<i>Muhlenberg College</i>),	Allentown.

BACHELOR OF ARTS

WILLIAM ANDREW BECK, JR.,	Englewood, N. J.
HOWARD STOLPP BUNN,	Elkins Park.
ROBERT SCHWARTZ COPE,	Bethlehem.
BOYD ROSS EWING, JR.,	Allentown.
HOBART AMORY FARBER,	Northampton.
CLYDE REUBEN FLORY,	Edelman.

JAMES CULLEN GANEY,	Bethlehem.
PHILIP RANDOLPH HILLS,	Mill Hall.
WILLIAM ALFRED KREIDLER,	Bethlehem.
WILLIAM DAVID MAGINNES,	New York, N. Y.
MERCER BROWN TATE, JR.,	Harrisburg.

BACHELOR OF SCIENCE

PRESTON CLAYTON BARTHOL,	Bethlehem.
SHELDON VANDERBILT CLARKE,	Williamsport.
ARTHUR WILLIAM DuBOIS,	Coudersport.
JACOB ALLEN GARDY,	Doylestown
HAROLD FREDERICK GOLDING,	Trenton, N. J.
LAWRENCE HARTMAN HARWI,	Bayonne, N. J.
JOHN MYERS HOWARD, JR.,	Latrobe
LEONARD PHILLIPS LEVERICH,	Brooklyn, N. Y.
ARTHUR WYNDHAM LEWIS,	Martin's Ferry, O.
JOSEPH GEGGUS OBERT,	Lehighton

CIVIL ENGINEERING

WILLIAM RAYMOND ALLGAIER,	Philadelphia.
JOHN STERRETT BAREFOOT,	Milroy.
EDWIN BOOTH,	Carbondale.
ALVIN NEWTON BUGBEE,	Trenton, N. J.
PETER ALOYSIUS CARR,	Freeland.
HAROLD HODGKINS DEWHIRST,	Washington, D. C.
FERNANDO GONZALES,	Torreon, Mexico.
RICHARD HOLMES GRUBBS,	Baltimore, Md.
PHILIP CONRAD HAMMOND,	Bridgeport, Conn.
HARRY G. LEVY,	Hazleton
OSCAR EZRA LEWINE,	Atlantic City, N. J.
CYRIL GLENNON MELVILLE,	Harrisburg.
JEROME JOHN MIELDAZIS,	Shenandoah.
JOSEPH SHIKRI NAAME,	Atlantic City, N. J.
MILNOR PECK PARET, JR.,	Lake Charles, La.
JOSEPH ALFRED REINHARDT,	Brooklyn, N. Y.
LEONARD EDWARD RUF,	Philadelphia.
CHARLES FREDERICK RUFF,	Philadelphia.
JOSEPH SPAGNA,	Avon, Mass.
EDWARD STOTZ, JR.,	Pittsburgh.
JAMES MOSER STRAUB,	Canonsburg.
JOHN IRVING TIMMONS,	Snow Hill, Md.
AUGUST HANS WAGENER,	Ellicott City, Md.
JOHN HAROLD WAGNER,	Harrisburg.

MECHANICAL ENGINEER

ENGELBERT HENRY BADERSCHNEIDER,	Monongahela.
JOHN BEARD,	Germantown.
RUSSELL SYLVESTER BELLMAN,	Louisville, Ky.
JOHN GEORGE BERGDOLL, JR.,	York.
JACOB ARIEL BISHOP, B.A.,	Chambersburg.
(<i>Lehigh University</i>),	
WILLIAM ARTHUR CARR,	Washington, D. C.
RUSSELL WILLIAM HERBERT DANZER,	Bethlehem.
EDWARD WYNNE ESTES,	Bethlehem.
ARTHUR RANDOLPH EVANS,	Freeland.
EDWARD LOGAN FORSTALL,	Rosemont
JOSEPH LEWIS GEIGER,	Scarletts Mills.
ALFRED WILLIAM GLASER,	Baltimore, Md.
EUGENE DEWEY HEIMBACH,	Renovo.
CLARKSON TOMS HUNT,	Lansdowne.
RALPH JOHNSON KNERR,	Claussville.
RANDOLPH OSGOOD LEWIS,	Washington, D. C.
AUDATO LORENZO MUÑOZ	Santa Barbara, Honduras.
EDGAR FRANKLIN MUTH,	Northampton
ROBERT JOSEPH OTT,	Bethlehem.
LAWRENCE FRANK REED,	Orwigsburg.
WILLIAM HENRY SCHLASMAN,	Reading.
ALFRED ELWOOD MORTON SHAFER,	Lehighton.
JULIUS HERMAN SPALDING,	Pottsville.
ROBERT CHARLES WEISHAUP,	Lancaster.

METALLURGICAL ENGINEER

JOHN GORDON BELL,	Canton, O.
ROBERT EMERSON BROWN,	Butler.
BEALE BORDLEY DAVIDSON,	Elizabeth, N. J.
ROBERT BRODHEAD HONEYMAN,	Brooklyn, N. Y.

ELECTROMETALLURGIST

ELWOOD MAXWELL ALLAN,	Jermyn.
MAXWELL JACOBS BROOKS,	Niagara Falls, N. Y.
GENNERO DELLA CROCE,	Freeland.
WILLIAM CHRISTMAN DORSAM,	Brooklyn, N. Y.
JOHN BEAVER HEILMAN,	Lebanon.
WILLIAM JAMES KNERR,	Allentown.
AUGUST MAX KUHLMANN,	Washington, D. C.
MILTON JOSEPH LEROY,	Syracuse, N. Y.
ARNOLD DOLDER SPILLMAN,	Bethlehem.

CLARENCE WILLIAM WARNER,	Newark, N. J.
MARMADUKE REVENAUGH WOLFE,	New York, N. Y.
WILLIAM HENRY SIMMONS YOURY,	Newark, N. J.

ENGINEER OF MINES

LESTER NATHANIEL CHAPMAN,	Wollaston, Mass.
GEORGE A. GANTER,	New York, N. Y.
WILBUR REINOEHL HECK,	Ocean Grove, N. J.
JOSEPH AUSTIN HOLMES, 2ND,	Washington, D. C.
JOHN DONALD MCCARTHY,	Bethlehem.
NATHAN MATHAG,	New Haven, Conn.
JOSEPH LEWIS ROSENMILLER,	York.
HARRY SUYDAM SAXMAN,	Latrobe.
HOWARD LEE WEY,	Bristol, Conn.
CHUN TAI YEN,	Kiangsi, China.

ELECTRICAL ENGINEER

HOMER ALLISON BACHERT,	Bethlehem.
AUGUST CONCILIO,	Newton, N. J.
DARCY MATTHEW GEORGE,	Nazareth.
JOSEPH HERMAN,	Northampton.
SOLOMON HOFFMAN,	Baltimore, Md.
FREDERICK GARNER MACAROW,	Hazleton.
BENJAMIN ROSS NEVINS,	Tamaqua.
NORMAN ALBERT NEWELL,	West Hoboken, N. J.
FREDERICK MEREDITH PORTER,	York.
<i>(Lehigh University),</i>	
RICKLEF ALLEN REID,	Glen Ridge, N. J.
JOHN EMIL SCHMICH,	Bethlehem.
WILLIAM BLOTTENBERGER SHIRK,	Lebanon.
LLOYD MOSER SMOYER,	Allentown.
JOSEPH ANTHONY WENSK,	Baltimore, Md.
ALBERT JAMES WICK,	Washington, D. C.

CHEMICAL ENGINEER

FRED PETER DIENER,	Allentown.
FRANCIS JOHN GEORGE DUCK, B.S.,	Scranton.
<i>(St. Thomas College),</i>	
GEORGE HENRY ERWIN,	Bethlehem.
PHILIP DAVID GREENSTEIN,	Bridgeport, Conn.
WILLIAM HOPPE HUNTON,	Philadelphia.
HARRY KARTON,	Philadelphia.
ROLLIN REUBEN KEIM,	Bethlehem.

JOHN HENRY MERSFELDER, JR.,	Newark, N. J.
EDWARD ALLEN MOOERS,	Elmira, N. Y.
ARTHUR HECKFORD RANDALL,	Bloomfield, N. J.
HARRY CHARLES RICE,	Hazleton.
GEORGE STANLEY SCOTT,	East Mauch Chunk.
HAROLD DEWITT SMITH,	Bayonne, N. J.
HOWARD GREENWALD SOMMERS,	Allentown.
PHILIP SUBKOW,	Bethlehem.
AARON JESSE SUGAR,	Norfolk, Va.
JOHN HERMON TERRY, JR.,	Edgewater Park, N. J.
JAMES STANLEY THOMPSON,	Warehouse Point, Conn.
ROBERT ALEXANDER WILBUR, JR.,	Elmira, N. J.

HONORARY DEGREE MASTER OF ARTS

WARREN ABBOTT WILBUR,	Bethlehem.
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SCHOLARSHIPS, FELLOWSHIPS, AND PRIZES

THE WILBUR SCHOLARSHIPS

The Wilbur Scholarship was founded in 1872 by the late E. P. Wilbur and is the sum of \$200 awarded annually to the student in the Sophomore Class having the best record.

THE HARRY S. HAINES MEMORIAL SCHOLARSHIPS

Mrs. Henry S. Haines, of Savannah, Georgia, established in 1889 a scholarship of the annual value of \$200 as a memorial to her son, Henry Stevens Haines, M.E., a member of the Class of 1887. This scholarship is devoted to the support at Lehigh University, throughout his scholastic career, of one student in the Course of Mechanical Engineering.

THE FRED. MERCUR MEMORIAL FUND SCHOLARSHIPS

Friends of the late Frederick Mercur, of Wilkes-Barre, Pennsylvania, General Manager of the Lehigh Valley Coal Company, desiring to establish a memorial of their friendship and esteem, and to perpetuate his memory, contributed and placed in the hands of the Trustees a fund called "The Fred. Mercur Memorial Fund," sufficient in amount to insure the award of three scholarships for free tuition in the University.

THE JOSEPH MANN PRICKITT SCHOLARSHIP

Mr. and Mrs. Cooper H. Prickitt, of Burlington, New Jersey, established, in April, 1919, a scholarship, to be known as the Joseph Mann Prickitt Scholarship, in memory of their son,

Joseph Mann Prickitt, of the Class of 1917, who died on March 10, 1916.

This scholarship is of sufficient amount to cover expenses for tuition, fees and books. It is the expressed wish of the donors that the scholarship be awarded to graduates of the Burlington, New Jersey, High School on the nomination of the Principal of that school, subject to the approval of the President of the University, or in case of no nomination from that school that the award be made to deserving students from other places.

THE ECKLEY B. COXE MEMORIAL FUND

In memory of the late Eckley B. Coxe, Trustee of the University, Mrs. Coxe has established a fund, amounting to \$30,000, the interest of which is used, under the direction of the Trustees of the University, and subject to such regulations as they may adopt, for the assistance of worthy students requiring financial aid.

THE FRANK WILLIAMS FUND

Frank Williams, E.M., of Johnstown, Pennsylvania, a graduate of the course in Mining and Metallurgy of the Class of 1887, who died October, 1900, bequeathed to the University the greater part of his estate, now amounting to over \$120,000, to found a fund, the income of which is lent to deserving students. At present the larger part of this income is devoted to certain life tenants under Mr. William's will. After their death the entire income will be available.

THE DUPONT FELLOWSHIP

In June, 1918, E. I. duPont de Nemours and Company, for the purpose of encouraging the study of Chemistry, offered an annual scholarship of \$350 to be awarded to a senior student or graduate student in the Department of Chemistry and Chemical Engineering. For the collegiate year, 1920-1921, the amount was increased to \$750 for the establishment of a fellowship.

THE GEORGE D. CALLENDER FELLOWSHIP

The George D. Callender Fellowship for the promotion of research in chemistry is a gift of \$1500 for the collegiate year, 1920-1921, bestowed by an anonymous friend of the late George D. Callender, a chemist who died in Chicago in 1914 while associated with the donor of the scholarship. Mr. Cal-

lender was a native of Linlithgow, Scotland, and was graduated from the chemistry department of Glasgow University.

WILBUR PRIZES

A fund was established by the late E. P. Wilbur for distribution in prizes as the Faculty shall determine. This fund yields an annual income of \$100.

THE PRICE PRIZE FOR ENGLISH COMPOSITION

Dr. Henry R. Price, an alumnus and Trustee of the University, established in 1898 an annual prize of the value of \$25, to be awarded in June to that member of the Freshman Class who shall write the best essay on a topic in English Literature assigned by the head of the Department of English not later than the beginning of the second term in each year. Especial stress will be laid upon clearness of thought and force of expression.

Students must signify in writing their intention of competing not later than the first of April.

The subject for the prize essay in June, 1921, will be: "Literature in New York Before 1870."

THE JOHN B. CARSON PRIZE

An annual prize of \$50 was established in 1909 by Mrs. Helen C. Turner, of Philadelphia, Pennsylvania, in memory of her father, John B. Carson, whose son, James D. Carson, was a graduate of the Civil Engineering Department of Lehigh University in 1876. It is awarded for the best thesis in the Civil Engineering Department.

WILLIAM H. CHANDLER PRIZES IN CHEMISTRY

Four annual prizes in chemistry of \$25 each were established in 1920 by the gift of Mrs. Mary E. Chandler, of Bethlehem, widow of Dr. William H. Chandler, who was Professor of Chemistry in Lehigh University from 1871 until his death in 1906. In memory of Dr. Chandler the Faculty named the prizes "The William H. Chandler Prizes in Chemistry." Awards are made at the commencement exercises in June to the four members of the Freshmen, Sophomore, Junior and Senior classes deemed by the Faculty worthy to receive them.

THE ALUMNI ASSOCIATION

The Alumni Association, which has been in existence since 1876, was incorporated in 1917 under the name The Alumni Association of the Lehigh University, Inc. The Alumni Sec-

retary, who devotes all of his time to Association affairs, is Walter R. Okeson, '96, whose offices are in Drown Memorial Hall. Mr. Okeson edits the *Lehigh Alumni Bulletin*, a news publication published monthly from October to June, inclusive, and the *Alumni and Student List*. An appointment bureau is maintained by the Association.

The officers of the Alumni Association for 1920-21 are:

President, Charles D. Marshall, '88, of Pittsburgh.
Vice-President, H. D. Wilson, '01, of Pittsburgh.
Vice-President, Robert Farnham, '99, of Philadelphia.
Treasurer, Alan C. Dodson, '00, of Bethlehem.
Secretary, Walter R. Okeson, '96, of Bethlehem.
Archivist, Preston A. Lambert, '83, of Bethlehem.

Honorary Alumni Trustees: Franklin Baker, Jr., '95, of Philadelphia; Henry H. Scovil, '00, of Pittsburgh; Homer D. Williams, '87, of Pittsburgh, and William C. Dickerman, '96, of New York.

The following are the local alumni clubs: New York Lehigh Club, Philadelphia Lehigh Club, Pittsburgh Lehigh Club, Chicago Lehigh Club, Washington Lehigh Club, Detroit Lehigh Club, Northeastern Pennsylvania Lehigh Club (Scranton and Wilkes-Barre), Maryland Lehigh Club (Baltimore), Lehigh Club of New England (Boston), Intermountain Lehigh Club (Salt Lake City, Utah), Lehigh Club of Central Pennsylvania (Harrisburg), Lehigh Club of Northern New York (Schenectady), Lehigh Club of Northern Ohio (Cleveland), Lehigh Club of Southern New England (Hartford), Lehigh Club of Western New York (Buffalo), Southern Anthracite Lehigh Club (Pottsville), Southwestern Lehigh Club (St. Louis), Lehigh Home Club (Bethlehem), Lehigh Club of China (Wuchang), Lehigh Club of Cuba (Havana).

ALUMNI PRIZES

By a resolution of the Alumni Association of September 21, 1900, the Alumni Scholarship Fund, which was originally designed to help poor students, was with the consent of the contributors diverted from this purpose and the income devoted to prizes to members of the Junior Class. In June, 1921, two prizes of \$25 each will be awarded to the first honor men of the course in Mechanical Engineering and of the courses in Metallurgy and Mining Engineering. In sub-

sequent years the prizes will be awarded to the first honor men of the other technical courses in turn.

ALUMNI PRIZES FOR ORATORY

The Alumni Association of Lehigh University established in 1882 annual prizes for excellence in oratory, amounting to \$50.

REGULATIONS

1. The contest shall be held on the 22nd day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of \$25, a second prize of \$15, and a third prize of \$10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the orations shall be announced at the beginning of the first term of every year, and upon one of these each competitor shall write an oration not to exceed 1200 words, taking about eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do—should they be sufficient in number—the best six shall be chosen and their envelopes opened. The others shall be returned to the addresses given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors whose orations shall have been approved, and the awards shall be made by a majority of these judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

The annual contest in Oratory for the Alumni Prizes was held on February 21, 1920, with the following competitors:

Robert Dominick Billinger, of Shenandoah, Pennsylvania.

Edmund Warren Bowden, of Camden, New Jersey.

Benjamin Ettelman, of Philadelphia, Pennsylvania.

Abraham Fleischer, of Baltimore, Maryland.

Willis Jones Parker, West Pittston, Pennsylvania.

The first prize was awarded to Mr. Bowden, the second to Mr. Billinger, and the third to Mr. Ettelman.

The judges were William A. Lambert, '95; Walter R. Okeson, '96, and Dr. Arthur D. Thaeler.

WILLIAMS PRIZES IN ENGLISH

Professor Edward H. Williams, jr., an alumnus of the University, a graduate of the Class of 1875, established in February, 1900, prizes amounting annually to three hundred and thirty-five dollars for excellence in English Composition and Oratory. The conditions of the endowment are as follows:

Sophomore Composition Prizes

1. At the beginning of each term the Sophomore Class shall be divided into two sections alphabetically and to that student in each section who, at the end of a term, and of each term, shall receive the highest rank in English Composition during that term shall be awarded the "First Sophomore Composition Prize" of ten dollars, and to that student in each section as aforesaid who shall receive the next highest rank in the same subject shall be awarded the "Second Sophomore Composition Prize" of five dollars. In each year there will be offered four first and four second prizes—a total of sixty dollars.

If more than one student shall receive the highest rank in any section, the amount of the two prizes shall be added together and the sum—fifteen dollars—shall be equally divided between them, and no second prize shall be offered in that section. If more than one student shall receive the next highest rank in any section when there is but one contestant for the first prize, the second prize shall be equally divided between the two having the second rank.

Senior Premiums

2. The Faculty shall publish within one month of the end of the University year a list of subjects for dissertations, selected from English Literature and Economics, entitled Subjects for Senior Premiums. To this list shall be appended a date near the first of January following—to be determined upon by the Faculty—when the contest shall be declared closed and the dissertations shall become due.

From the above list any member of the Senior Class may select a subject and write thereon a dissertation, whose length shall be prescribed by the Faculty, and shall send the same anonymously, but marked for identification, as the Faculty may direct, to the Secretary of the Faculty before the date aforesaid.

The Faculty, or its committee, shall meet on the above date and at subsequent adjourned meetings, and, first, having determined upon a standard of excellence which each and all dissertations must reach in order to be admitted to the following competition, shall examine the dissertations submitted to them and admit those which reach the above standard. In case none are up to the standard, and are admitted they shall declare the contest closed for that year, and no prizes shall be awarded.

If one or more dissertations are admitted as aforesaid, the Faculty, or its committee, shall arrange them in the order of their literary merit and soundness of their reasoning, and the six highest in this arrangement shall be retained and all others returned as directed by the writers, who shall remain unknown. The names of the successful

writers shall be ascertained and they shall be required to recast their dissertations in the form of an oration, and to speak the same in public at such time during the Commencement Week as the Faculty shall determine.

The Faculty, or its committee, shall be the judges of excellence in the speaking, and shall award to that Senior student who shall speak his oration in the best manner, the Senior Gold Medal, of the value of one hundred dollars, or, at his option, one hundred dollars in gold. They shall award to the other five speakers the five Senior Premiums of ten dollars each.

Graduate Prize

3. At the end of the University year, during Commencement Week, the Faculty shall publish a second list of subjects for theses selected from English Literature, Economics, Mental and Moral Science, and similar subjects which require thought and application, and which must be of such a character that their mastery shall be accomplished only through considerable research and study.

From this list any member of the class just graduating; the Senior Class of the coming University year; a graduate of one year's standing whether in or out of residence, and a graduate of any class who may be, during the coming year, in actual residence and taking post-graduate work in the University, may select a subject and write thereon a thesis of not less than five thousand words and send the same to the Secretary of the Faculty, anonymously, but marked for identification as the Faculty may designate, before the date, which the Faculty shall select within one month before the next Commencement, and which date must appear on the above list.

The Faculty, or its committee, shall meet on this date, and at adjourned meetings thereafter, and, having first established a standard of excellence, which must, first, be a high one, and second, shall require on the part of the competitor ability in the plan, development, argument, and conclusion of the work, as well as literary merit in its composition and presentation, shall admit to the following competition only those who fully attain to the above required standard.

If none of the theses submitted shall have attained to the standard aforesaid, the competition shall be declared closed and the prize shall not be awarded.

To the author of that thesis which shall have been admitted to the competition, and which shall have been declared of the highest excellence, the Graduate Prize of one hundred and twenty-five dollars shall be awarded and presented on Commencement Day with the other prizes and awards of that day.

The successful thesis shall be the property of the University, but the author shall be allowed to retain one copy. Publication of the thesis by the author will only be permitted by vote of the Faculty. Such publication must, however, be entitled Graduate Prize Thesis of the Lehigh University.

The winner of a prize shall not be allowed to compete again.

Professor Williams has directed that the income derived from the endowment for the Williams Prizes shall be applied and used as follows:

1. All portions of said income remaining after the payment of all prizes awarded in any one year, shall be invested and added to the principal of said endowment.

2. If any prize shall, for any reason, be not awarded in any year, the sum thus unpaid shall be invested and added to the said principal.

3. If for any reason the amount of the income from said endowment shall fall below the total sum necessary to pay said prizes, the amounts of the individual prizes shall be proportionally reduced till their sum shall be equal to three-fourths of the said reduced income, and this three-fourths shall be used to pay them; the remaining one-fourth is to be invested and added to the said principal.

4. This investment of residues, as above said, shall continue till the principal of said endowment shall be sufficiently large to furnish an income at two per cent. interest, which will be sufficient to pay all said prizes now established.

5. When said principal shall be large enough to furnish the necessary sum to defray the said prizes, as stated in No. 4, the surplus income remaining after paying all the prizes awarded during the year shall be used by the President of the University to encourage oratory, debate, or any other object decided upon by the Faculty.

THE FRAZIER AND RINGER MEMORIAL FUND

This is a fund for the medical and surgical care of needy students, established in memory of Benjamin West Frazier, A.M., Sc.D., formerly Professor of Mineralogy and Metallurgy, and Severin Ringer, U.J.D., formerly Professor of Modern Languages and Literatures and of History, each of whom faithfully served Lehigh University for one-third of a century. The fund was started February 12, 1906, by the donation of thirteen thousand dollars by the late Robert H. Sayre. It is the hope and expectation of the friends of the University that this fund may, by other donations, be increased in time to amount to a sum sufficient to insure free medical and surgical attendance to all students of the University requiring such aid.

STUDENTS

B.A.—Bachelor of Arts.	E.M.—Mining Engineering.
Bus.—Business Administration.	El.Met.—Electrometallurgy.
C.E.—Civil Engineering.	M.E.—Mechanical Engineering.
Ch.E.—Chemical Engineering.	Met.—Metallurgy.
Chem.—Chemistry.	N.E.—Ship Construction and
E.E.—Electrical Engineering.	Marine Transportation.

The names in the following lists include all the students who have registered and attended recitations at the University for the current year.

GRADUATE STUDENTS

	FOR DEGREE	RESIDENCE
Anderson, Harold Victor,	M.S.,	Bethlehem.
B. Ch.E., (<i>University of Michigan.</i>)		
Anderson, Rachel E., B.A.,	M.S.,	Easton.
(<i>Wellesley College.</i>)		
Arnold, Herbert Franklin, A.B., M.A.,		Easton.
(<i>Franklin and Marshall College.</i>)		
Bachman, Charles Clinton, A.B., M.A.,		Allentown.
A.M., (<i>Muhlenberg College.</i>)		
Barthold, William Gregory, B.A., M.A.,		Bethlehem.
(<i>Lehigh University.</i>)		
Bauman, John Edmiston, A.B., M.A.,		Allentown.
C.E., M.S., (<i>Lehigh University.</i>)		
Beaver, Jacob Lynford, E.E.,	M.S.,	Bethlehem.
(<i>Lehigh University.</i>)		
Billow, Milton Oscar, B.A.,	M.A.,	Harrisburg.
(<i>Lebanon Valley College.</i>)		
Brockman, Charles Joseph, B.A., M.A.,		Nazareth.
(<i>Lehigh University.</i>)		
Brunner, William Albert, B.A., M.A.,		Harrisburg.
(<i>Lebanon Valley College.</i>)		
Buck, Leonard Jerome, E.M.,	M.S.,	Bethlehem.
(<i>Lehigh University.</i>)		
Burke, James Michael, B.S.,	M.S.,	Akron, Ohio.
(<i>Lehigh University.</i>)		
Carter, Wayne Hanley,	M.S.,	Bethlehem.
B.S. (in Chem.), (<i>Lehigh University.</i>)		
Concilio, August, E.E.,	M.S.,	Bethlehem.
(<i>Lehigh University.</i>)		

- Diefenderfer, Herbert H., B.S., M.S., South Amboy, N. J.
(Pennsylvania State College.)
- Doan, Gilbert Everett, Ch.E., M.S., Annapolis, Md.
(Lehigh University.)
- Frankenfield, Ira M., B.S., M.S., Coopersburg.
(Muhlenberg College.)
- Friedlander, Sarah, B.A., M.A., Allentown.
(Hunter College.)
- Fegley, Solon J., A.B., M.S., Allentown.
(Lafayette College.)
- Glasier, J. Arthur, B.D., M.A., Bethlehem.
(General Theological Seminary.)
- Grubb, Percy Lamar, B.A., M.A., Harrisburg.
(Lehigh University.)
- Hausmann, Alfred Carl, B.A., M.A., Fox Chase.
(Lehigh University.)
- Hess, Mary L., A.B., M.A., Hellertown.
(Allentown College for Women.)
- Higgins, Emerson Corson, Jr., M.S., Tulsa, Okla.
 B.S., *(Lehigh University.)*
- Ho, Chee Kin, B.E.M., M.S., Hong Kong, China.
(University of Illinois.)
- Hoch, Helena M., B.A., M.A., Bethlehem.
(Moravian College for Women.)
- Ischinger, Robert H., B.D., M.A., Allentown.
(Mt. Airy Lutheran Theological Seminary.)
- Jacobs, Homer Miller, Ph.B., M.A., Easton.
(Lafayette College.)
- Jones, Ernest E., B.S., M.S., Palmerton.
 M.S. (in Chem.), *Johns Hopkins University, University of Chicago.)*
- Kamura, Heihachi, Met.E., M.S., Saga, Japan.
(Meiji College of Technology, Japan.)
- Karsch, Carl Henry, A.B., M.A., Allentown.
(University of Pennsylvania.)
- Kast, Bessie Edna, B.A., M.A., Harrisburg.
(Wellesley College.)
- Lawall, Charles Elmer, Jr., E.M.,
(Lehigh University.) M.S., Allentown.
- Lu, Chang-Chih, E.E., M.S., Canton, China.
(Lehigh University.)

- McCullough, Herry Rath, A.B., M.A., Allentown.
(*Muhlenbedg College.*)
- Marcks, Frederick Augustus, M.A., Nazareth.
B.A., (*Muhlenberg College.*)
- Martin, Robert Earl, A.B., M.A., Bethlehem.
(*University of Indiana.*)
- Rex, Barron P., Ph.B., M.S., Easton.
(*Lafayette College.*)
- Ringleben, August A., A.B., M.A., Hazleton.
(*Ursinus College.*)
- Schealer, Samuel Raymond, E.E., M.S., Bethlehem.
(*Lehigh University.*)
- Sheaffer, Ira Lee, B.S., M.S., Northampton.
(*Muhlenberg College.*)
- Shafer, Bentley Sayre, B.A., M.A., Asheville, N. C.
(*Lehigh University.*)
- Shedd, Thomas C., Sc.B., M.S., Phoenixville.
(*Brown College.*)
- Smull, Judson Gray, M.S., Bethlehem.
B.S. (in Chem.) (*Lehigh University.*)
(George D. Callender Fellow in Chemistry.)
- Strunk, Elvira M., B.S., M.S., Changsha, Hunan,
(*Albright College.*) China.
- Subkow, Philip, Ch.E., M.S., Bethlehem.
(*Lehigh University.*)
- Tatnal, Edna Grace, A.B., M.A., Harrisburg.
(*Pennsylvania College for Women.*)
- Ward, Arthur Thomas, El.Met., M.S., Bellefonte.
(*Lehigh University.*)
- Weirbach, T. Mahlon, A.B., M.A., Allentown.
(*University of Michigan.*)
- Wentz, Herbert Homer, B.S., M.S., Allentown.
(*Muhlenberg College.*)
- Wetherhold, Ralph V., B.S., M.S., Allentown.
(*Muhlenberg College.*)
- Yeager, Howard James, A.B., M.A., Emaus.
(*Franklin and Marshall College.*)
- Zerfass, Elizabeth, A.B., M.A., Phillipsburg, N. J.
(*Randolph-Macon Women's College.*)
- Ziegenfuss, Warren Allen, A.B., M.A., Allentown.
(*Muhlenberg College.*)
-

- Bunn, Howard Stolpp, B.A., Ch.E., Elkins Park.
(Lehigh University.)
- Cassler, George Williams, B.A., Ch.E., Hollsopple.
(Susquehanna University.)
- Chang, Kin-Fang, B.A., Met., Shanghai, China.
(St. John's University, Shanghai, China.)
- Elguin, Agustin Nazario, C.E., E.M., Santiago, Chile.
(University of Chile.)
- Hobbs, Douglas Brown, B.A., Met., Church Hill, Md.
(University of the South.)
- Huebner, Richard Victor, B.S., Bus., Allentown.
(Pennsylvania Military College.)
- Leighton, Tomas Rafael, C.E., E.M., Santiago, Chile.
(University of Chile.)
- Lloyd, Francis James, B.A., C.E., Pocomoke City, Md.
(St. John's College.)
- Marsh, Harry Harrison, Jr., A.B., E.E., Wheeling, W. Va.
(Marietta College.)
- Tait, Watson Fergus, Jr., A.B., E.E., Parkersburg, W. Va.
(Marietta College.)

- Danieri, Francisco, A.N., Spl. Met., Buenos Ayres,
(Argentine Naval Academy.) Argentine Republic, S. A.
- Pelot, Joseph Halley, U.S.A., Spl. Met., Washington, D. C.
(United States Military Academy.)
- Darrow, Robert Turner, U.S.N., Spl. Met., Washington, D. C.
(United States Naval Academy.)
- Granat, William, U.S.N., Spl. Met., San Francisco, Cal.
(United States Naval Academy.)
- Morell, Norberto (Salinas), S.N., Spl. Met., Cartagena, Spain.
(Spanish Army Artillery School.)
- Uihlein, Ralph Alfred, Ph.B., Spl. Met., Milwaukee, Wis.
(Yale University.)

SENIOR CLASS

Class of 1921

	COURSE	RESIDENCE
Alden, John Herbert,	El.Met.,	Washington, D. C.
Arner, William Joseph,	El.Met.,	Allentown.
Bailey, Harry Chantler,	C.E.,	Crafton.
Barthold, Allen Jennings,	B.A.,	Bethlehem.
Baver, David Ezra,	E.E.,	Shoemakersville.
Berger, Edgar Milton,,	M.E.,	Allentown.
Berner, Carl Richard	C.E.,	Pottsville.
Bertolet, John Lorah,	Ch.E.,	Reading.
Bevan, Lathrop,	C.E.,	East Orange, N. J.
Billinger, Robert Dominick,	Ch.E.,	Shenandoah.
Bingham, William Redmond,	Met.,	Harrisburg.
Blake, Robert Dayton,	B.A.,	Bethlehem.
Boland, William Henry,	M.E.,	Bethlehem.
Bowden, Edmund Warren,	C.E.,	Camden, N. J.
Boynton, Henry Gaines,	Bus.,	New York, N. Y.
Brucher, Adam, Jr.,	B.A.,	Northampton.
Brugmann, William Hugh,	Met.,	Rutland, Vt.
Burgess, Eugene Willard,	Bus.,	Chicago, Ill.
Butz, Louis Neuweiler,	El.Met.,	Allentown.
Chen, Chi-fah,	E.M.,	Amoy, China.
Childs, George Lawton,	Bus.,	New York, N. Y.
Childs, Raymond Austin,	Bus.,	New York, N. Y.
Chou, Smie S. K.,	M.E.,	Patung, Hupeh, China.
Christman, Frederick Mertz,	Ch.E.,	Reading.
Christman, LeRoy Fisher,	C.E.,	Womelsdorf.
Clark, Gerald Hunt,	B.A.,	Andover, N. J.
Claxton, Edmund,	Ch.E.,	Narberth.
Comey, Paul Van Amringe,	Ch.E.,	Wenonah, N. J.
Coppersmith, Edward Adolph,	M.E.,	Egypt.
Davenport, Harold Robertson,	El.Met.,	West Pittston.
Dembo, Louis Julius,	C.E.,	Baltimore, Md.
Dixon, Lyman LeRoy,	E.M.,	Flushing, N. Y.
Dougherty, James Gwynne,	El.Met.,	Beaver.
Dyer, Harry Buttorff,	C.E.,	Nashville, Tenn.
Esterson, Milton Max,	M.E.,	Baltimore, Md.
Ettelman, Benjamin,	C.E.,	Philadelphia.
Farrington, James Royce,	C.E.,	Annandale, N. J.

Feringa, Peter Anthony,	C.E.,	Grand Haven, Mich.
Fisher, Lloyd Wellington,	B.A.,	Reading.
Flanagan, Frank Patrick,	E.M.,	Roanoke, Va.
Fleischer, Abraham,	C.E.,	Baltimore, Md.
Flom, Samuel Louis,	C.E.,	Northampton.
Forstall, Alfred Edmond, Jr.,	Bus.,	Montclair, N. J.
Frank, Paul Melville,	E.M.,	Allentown.
Frankenfield, Warren Ezra,	M.E.,	Ambler.
Gaiser, George Lincoln,	C.E.,	Newark, N. J.
Garrett, William Starling,	M.E.,	Roanoke, Va.
Goldman, Hyman,	Ch.E.,	Easton.
Gonzales, Eduardo,	M.E.,	Torreón, Mexico.
Good, Robert Charles,	Met.,	Camp Hill.
Goodwin, James Heathcott,	Bus.,	East Liverpool, O.
Gott, Eugene Cissell, Jr.,	El.Met.,	Washington, D. C.
Gulick, Henry Burr,	Ch.E.,	Brooklyn, N. Y.
Hall, Frank Allen,	B.A.,	Middletown, Conn.
Hall, William McLaurine, Jr.,	Ch.E.,	Parkersburg, W. Va.
Hartzell, Ralph,	Bus.,	York.
Heiligman, Harold Abraham,	Ch.E.,	Lehighton.
Henneberger, Thomas Clinton,	E.E.,	Chambersburg.
Henrich, Vincent Christian,	Ch.E.,	Lebanon.
Hicks, Robert Clayton, Jr.,	E.E.,	Philadelphia.
Hollenback, Elliott Hudson,	El.Met.,	Wyomissing.
Hollinshead, Earl Darnell,	E.M.,	Mt. Kisco, N. Y.
Hood, John William,	El.Met.,	Knoxville, Tenn.
Huebner, James Kistler Mosser,	E.M.,	Allentown.
Ilyus, Edmund Burwell,	E.E.,	Lancaster.
Jenness, Edwin Hutchins,	M.E.,	Henry, Ill.
Judson, Walter Joseph,	C.E.,	Washington, D. C.
King, Walter Cornelius,	Ch.E.,	Bethlehem.
Kleckner, Ellis Henry,	M.E.,	Bethlehem.
Kline, John Milton,	Met.,	Allentown.
Kline, Luther Henry,	B.A.,	Northampton.
Knerr, George Russell,	Ch.E.,	Allentown.
Larson, Harry Gustave,	C.E.,	Limestone, N. Y.
Lawrie, William Newbold,	Bus.,	Oxford.
Lewers, William Wright,	Ch.E.,	Wilkes-Barre.
Locke, Harold Glenwood,	Ch.E.,	Camden, N. J.
Loeser, Edward Martin,	Ch.E.,	Elizabeth, N. J.
Maddox, Henry Randolph,	M.E.,	Baltimore, Md.
Maginnes, Albert Bristol,	B.A.,	Sharon, Mass.

March, Walter Stokley, Jr.,	E.M.,	Cynwyd.
Maurer, Charles Pehle,	E.M.,	Wilkes-Barre.
Miller, Albert Jacob,	M.E.,	Easton.
Miller, Frank William,	C.E.,	Reading.
Morgan, James Willard,	E.M.,	Altoona.
Morgan, Warren Thomas,	M.E.,	Freeland.
Mullady, Thomas Francis,	E.M.,	Brooklyn, N. Y.
Myers, Walter Frey, Jr.,	E.M.,	York.
Nass, George, III.,	M.E.,	Philadelphia.
Nesterowicz, John James,	Ch.E.,	Buffalo, N. Y.
Norkiewicz, John Anthony,	C.E.,	Shenandoah.
Oehm, Frederick Arthur,	M.E.,	Baltimore, Md.
Ostrolenk, Samuel,	E.E.,	Canby, Minn.
Overton, Sereno Burnell,	M.E.,	Southampton, N. Y.
Parker, Willis, Jones,	B.A.,	West Pittston.
Perry, Robert Swain, Jr.,	Ch.E.,	New York, N. Y.
Pfeiffer, David Clifford,	M.E.,	Washington, D. C.
Power, Paul Carroll,	Met.,	Crafton.
Powles, John Grant,	Met.,	Los Angeles, Cal.
Pumphrey, John Walter,	C.E.,	Brooklyn, Md.
Pursel, Harold Reinhardt,	M.E.,	Danville.
Raiguel, Jackson Bornman,	Ch.E.,	Jenkintown.
Rathbone, Monroe Jackson, Jr.,	Ch.E.,	Parkersburg, W. Va.
Rheinfrank, Frederick Wagner,	Bus.,	Port Chester, N. Y.
Richards, Samuel Simes, Jr.,	Ch.E.,	Rosemont.
Riebe, Herman William,	C.E.,	Lansford.
Ritchie, Paul,	M.E.,	Millville, N. J.
Robinson, Robert Parks,	C.E.,	Chester.
Rogers, Bryant King,	E.M.,	Montclair, N. J.
Roche, George Joseph,	E.E.,	Baltimore, Md.
Roy, Ernest Hood,	M.E.,	Newton, N. J.
Roy, Ernest Hood,	Ch.E.,	Mt. Airy, Md.
Rudy, Walter Dana,	Ch.E.,	Mt. Airy, Md.
Sakievich, Anthony Joseph,	C.E.,	Baltimore, Md.
Savaria, Gaspard Maurice,	E.E.,	Woonsocket, R. I.
Sayre, William Heysham, Jr.,	M.E.,	Glen Ridge, N. J.
Schrader, Michael Cornelius,	B.A.,	Bethlehem.
Schubert, Charles Samuel,	E.M.,	Roanoke, Va.
Schulz, Donald deVantier,	Met.,	Bethlehem.
Shipherd, John Jay,	Ch.E.,	Evansville, Ind.

Skillman, John Malcolm,	E.E.,	Oldwick, N. J.
Slabasesky, Henry Theodore,	E.E.,	Ashley.
Steacy, Henry Hershey,	M.E.,	York.
Stelle, Harold Alexander,	Ch.E.,	Scranton.
Summers, Milo Whitney,	C.E.,	Washington, D. C.
Sunderland, William Alexander,	E.M.,	Danbury, Conn.
Thomas, Ross Raymond,	M.E.,	Hammonton, N. J.
Thompson, George Stephen,	E.M.,	Shaft.
Tinker, Edward Lay,	E.E.,	West Haven, Conn.
Vogeley, Theodore Kenneth,	E.M.,	Butler.
Wasser, Norman Henry,	Ch.E.,	Bethlehem.
Weiss, Peter Francis,	B.A.,	Bethlehem.
Wentz, Ralph Roth,	El.Met.,	Allentown.
Whitmore, William Kendal,	E.M.,	Shamokin.
Widmyer, John Henry,	Chem.,	Lancaster.
Wildman, George Andrew,	E.E.,	Bridgeport, Conn.
Willard, Bradford,	B.A.,	Plainfield, N. J.
Wilson, Alvin Turner,	Ch.E.,	Bethlehem.
Woodring, Ralph Walton,	Ch.E.,	Bethlehem.
Wright, Charles Henry,	C.E.,	St. Clair.
Wright, Henry Ovington,	M.E.,	Westfield, N. J.
Yeide, Harry Elwood,	E.E.,	Weatherly.
Yu, Ching-Sung,	C.E.,	Kulangsu, Amoy,
		China.

JUNIOR CLASS

Class of 1922

	COURSE	RESIDENCE
Allen, Roy Dawson,	M.E.,	Belvidere, N. J.
Alrich, John Duffield,	E.E.,	Bethlehem.
Bachman, Wilbur George		
Tripple,	Bus.,	Allentown.
Bailey, Fred Elliott,	N.E.,	Cazenovia, N. Y.
Barthold, Lee Girard,	Bus.,	Bethlehem.
Beeckel, Hermann Charles,	E.M.,	Philadelphia.
Blom, Gustav Maurice,	C.E.,	Bethlehem.
Bobbin, Raymond Joseph,	Bus.,	Shenandoah.
Boltz, Joseph Light,	N.E.,	Lebanon.
Bowler, William Lloyd,	M.E.,	Glenside.
Bowman, Henry Tregellas,	M.E.,	Schuylkill Haven.
Bowman, Nelson, Blair,	E.M.,	Brownsville.

Bowman, Paul Emil,	Ch.E.,	Schuylkill Haven.
Brewer, Warren,	N.E.,	Newton Center, Mass.
Brumbaugh, Granville Martin,	E.E.,	Washington, D. C.
Brunstein, Maurice,	Ch.E.,	Atlantic City, N. J.
Bush, Donald Moyer,	Ch.E.,	Bethlehem.
Carey, James Stark,	Ch.E.,	Harrisburg.
Carpenter, Clinton Grier,	Ch.E.,	Brooklyn, N. Y.
Carroll, Henry,	M.E.,	Bethlehem.
Chen, Chung-Fa,	E.M.,	Changsha, China.
Chisholm, Henry Lewis, Jr.,	M.E.,	Buffalo, N. Y.
Clark, Richard James,	Ch.E.,	Bethlehem.
Cohen, Aaron Jacob,	C.E.,	Trenton, N. J.
Cohen, Samuel Meyer,	C.E.,	Bridgeport, Conn.
Coleman, Lee Heicher,	M.E.,	Steelton.
Connell, Charles Augustus,	M.E.,	Plattsburg, N. Y.
Corcoran, Lewis La Mont,	C.E.,	Bethlehem.
Cottrell, Samuel, Jr.,	Ch.E.,	Takoma Park, D. C.
Craig, Colgate,	Ch.E.,	Montclair, N. J.
Crawford, James Coalter, Jr.,	E.M.,	Mount Vernon, N. Y.
Culler, Roy Lester,	M.E.,	Mechanicsburg.
Daniels, Elliott Foster,	E.E.,	Jersey City, N. J.
Davis, Guild Darwin,	M.E.,	East Orange, N. J.
Day, Harrie Lyon,	Met.,	Ogdensburg, N. Y.
Deats, Charles Taylor,	E.E.,	Flemington, N. J.
DeTurk, Elmer Francis,	E.E.,	Reading.
Dimmig, Daniel Benjamin,	E.M.,	East Greenville.
Doan, William Douglas,	E.M.,	Lansdale.
Donovan, William Michael,	Bus.,	Philadelphia.
Downes, Kenneth McIntire,	Met.,	Harrisburg.
Downing, Edmond Joseph,	C.E.,	Scranton.
Drew, Leslie Lungren,	Bus.,	Asbury Park, N. J.
Dunkle, Charles Josiah,	Bus.,	Harrisburg.
Eastman, Robert William,	Met.,	Mount Vernon, O.
Eisenberg, Aaron Archibald,	Ch.E.,	Baltimore, Md.
Enslin, Everett Morgan,	N.E.,	Wilkes-Barre.
Ewing, George Newlin,	Met.,	Philadelphia.
Foote, Marshall Hanford,	Bus.,	South Norwalk, Conn.
Frain, Jacob Frank,	C.E.,	Williamsport.
Frankel, Harry,	B.A.,	Wilmington, Del.
Fresoli, Michael,	B.A.,	Bethlehem.
Fretz, John Clement,	E.E.,	Trenton, N. J.

Gangewere, Ernest Paul,	M.E.,	Chattanooga, Tenn.
Gerber, William Eugene,	Ch.E.,	York.
Gerlach, Jacob Aaron,	M.E.,	Easton.
Gillespie, Elwood David,	Ch.E.,	Catasauqua.
Glas mire, Frederick Wanner,	Ch.E.,	Bethlehem.
Glen, Maxwell,	Bus.,	Newbury, Mass.
Goldcamp, Cyril Finton,	Ch.E.,	Ironton, O.
Gooding, Charles Pennypacker,	B.A.,	Wilmington, Del.
Green, David,	N.E.,	Atlantic City, N. J.
Greenall, Charles Huntington,	M.E.,	Allentown.
Greene, Omar Vivien,	Met.,	Yonkers, N. Y.
Greenleaf, Eric Rodney,	Ch.E.,	Glen Ridge, N. J.
Gross, Abraham Albert,	Ch.E.,	Harrisburg.
Gulick, Wilson McKee,	E.M.,	Orange, N. J.
Handwerk, Erwin Casper,	E.M.,	Slatedale.
Hartshorne, Alfred Cope,	N.E.,	Phoenixville.
Herman, Arthur Louis,	Met.,	Bethlehem.
Herrington, Arthur Smith,	Bus.,	Latrobe.
Hewitt, Alfred George,	Ch.E.,	Washington, D. C.
Hindry, Walter Fitz James,	Ch.E.,	St. Augustine, Fla.
Hoch, Albert Jackson,	Met.,	Reading.
Hocker, John Stanley,	Met.,	Middletown.
Horine, John Winebrenner, Jr.,	E.E.,	Columbia, S. C.
Huang, Shou-Chuan,	E.M.,	Kaiping, Chihli, China.
Huber, Francis, Christian,	Ch.E.,	New York, N. Y.
Huffman, Francis Miller,	Met.,	Bethlehem.
Hughes, Rupert De Armond,	Ch.E.,	Montclair, N. J.
Ide, Clinton,	E.E.,	Harvey's Lake.
Irvin, Robert Lintner,	Met.,	Meadville.
Israel, Fielder,	Ch.E.,	Laurel, Md.
Jacobs, Frank Aaron,	Ch.E.,	Bethlehem.
Jacobs, Mahlon Kemmerer,	E.M.,	Philadelphia.
Jagels, Charles John Henry,	B.A.,	New York, N. Y.
Jefferson, Moncrief Ostrander,	N.E.,	Riverhead, N. Y.
Job, James Robert,	C.E.,	Nanticoke.
Kahn, Noah Abraham,	Ch.E.,	Bethlehem.
Keeley, Martin Jerome,	Bus.,	Jersey City, N. J.
Keenan, Raymond Anthony,	Met.,	New Kensington.
Kehler, Lloyd Benjamin,	M.E.,	Shamokin.
Kilbourn, William Robert,	M.E.,	Williamsport.
Kistler, George Anson,	C.E.,	Allentown.

Kivert, Joseph Albert,	Ch.E., Northampton.
Kleine, Herbert Julius,	M.E., Philadelphia.
Knies, Earl Vernon,	M.E., Bethlehem.
Knoderer, Claude Luther,	E.E., Steelton.
Korbel, Alexander,	M.E., Bethlehem.
Kozlakiewicz, Walter,	C.E., Wilkes-Barre.
Lamb, Earl Washington,	E.M., Natalie.
Larkin, Paul Revere,	C.E., Wollaston, Mass.
Larkin, Sylvester Makens,	C.E., Norristown.
Lerch, Robert Lee,	Ch.E., Takoma Park, D. C.
Linderman, Robert Packer,	Bus., Bethlehem.
Little, Arthur Rhea,	Met., Petersburg.
Lorch, George Herman,	E.E., Washington, D. C.
Lutz, Warren Hornberger,	E.E., Denver.
McGovern, Edward William,	Ch.E., Hammonton, N. J.
Major, Harold Wagner,	Ch.E., Lehman.
Maraspin, Davis Goodwin,	Bus., Malden, Mass.
Marshall, James Floyd,	M.E., Wilkes-Barre.
Marshall, John Noble,	C.E., Pittsburgh.
Mattson, William Raymond,	C.E., Rockledge.
de Menezes, Godofredo Moraes,	C.E., Brazil.
Michell, Albert McIlvaine,	E.M., Marion, Ky.
Miller, Paul Edward,	N.E., Bellwood.
Miller, Roy Francis,	E.M., Altoona.
Moorehouse, John Walter,	E.E., Monaca.
Morgan, Harold William,	C.E., Altoona.
Morris, Richard Henry, 3rd,	Ch.E., Philadelphia.
Mumma, Paul Fisher,	Met., Waynesboro.
Newlin, James Mennert,	E.M., Sparrows Point, Md.
O'Keefe, Gerald Carroll,	Bus., East Haven, Conn.
Pfeiffer, John,	Ch.E., Washington, D. C.
Platt, Harold Wentzell,	C.E., Bridgeton, N. J.
Potts, Ralph Harrison,	Ch.E., Reading.
Prigohzy, Adolph,	E.M., Brooklyn, N. Y.
Raff, Richard Davis,	Ch.E., Canton, O.
Reichard, Paul Clader,	M.E., Allentown.
Reynolds, Edwin Louis,	C.E., Bethesda, Md.
Rhoad, Robert Rodney,	N.E., Philadelphia.
Ricketts, Leslie Cutler,	M.E., Barre, Mass.
Salmon, Clarence Prior,	Met., La Salle, N. Y.
Saltzman, Auguste Louis,	M.E., East Orange, N. J.

Sanborn, Norman Prime,	C.E.,	Cleveland, O.
Satterthwait, Charles		
Shoemaker,	C.E.,	Burmout.
Schaefer, Bernard Edward,	E.M.,	Allentown.
Schier, Wallace,	Bus.,	Kew Gardens, L. I.,
Schlesman, Carlton Hecker,	Ch.E.,	Allentown. N. Y.
Schneider, Carl Louis,	M.E.,	Elizabeth, N. J.
Schwartz, Earl Dum,	C.E.,	Harrisburg.
Shearer, Walter Louis,	Ch.E.,	Washington, D. C.
Shipley, Samuel Hunt,	Ch.E.,	York.
Silsby, Charles Forbes,	Ch.E.,	Washington, D. C.
Smith, Hubert Bell,	C.E.,	Philadelphia.
Spatz, Warren Cyrus,	E.E.,	Reading.
Steiner, Carl Herman,	E.E.,	Reading.
Stimson, Earl, Jr.,	M.E.,	Baltimore, Md.
Strauch, Charles Carter,	M.E.,	Pottsville.
Stutz, George Frederick		
Adelbert, Jr.,	Ch.E.,	Washington, D. C.
Summers, Milo Whitney,	E.M.,	Washington, D. C.
Swinton, George Robert,	C.E.,	Atlantic City, N. J.
Switz, Theodore MacLean,	Ch.E.,	East Orange, N. J.
Tavener, William Henry,	E.M.,	Washington, D. C.
Terry, Peyton Leftwich,	M.E.,	Roanoke, Va.
Thaeler, Abraham Schropp,	N.E.,	Nazareth.
Tombler, Joseph,	Ch.E.,	Baltimore, Md.
Van Nort, Lawrence Northup,	M.E.,	Scranton.
Vogt, Harold James,	Ch.E.,	Brooklyn, N. Y.
Wallace, Harold Dolson,	C.E.,	East Orange, N. J.
Walters, George Wilmer,	E.M.,	Cazenovia, N. Y.
Waltz, William Hurr,	C.E.,	Williamsport.
Warren, Austin Bartlett,	N.E.,	Westfield, Mass.
Weber, Herman Ludwig,	B.A.,	Allentown.
Whims, Edmund Joseph,	C.E.,	St. Clair.
Whitney, Leslie Clifton,	Met.,	Marlboro, Mass.
Whytock, Paul Knauss,	Bus.,	Bethlehem.
Williamson, Stuart Worley,	E.M.,	Womelsdorf.
Wilson, John Edgar Miller,	E.M.,	Bethlehem.
Wilson, Ralph Lawrence,	Met.,	Canton, O.
Wingate, Abram Reber, Jr.,	C.E.,	Washington, D. C.
Woelfel, Harold Martin,	N.E.,	Freeland.
Wolfe, Charles Russell,	Ch.E.,	Asbury Park, N. J.

Wood, Robert Thomas,	Met.,	Palmerton.
Yap, Alfred Tsun Leong,	Bus.,	Honolulu, Hawaii.

SOPHOMORE CLASS

Class of 1923

	COURSE	RESIDENCE
Abel, Stanford Edward,	C.E.,	Washington, D. C.
Acker, Swope,	E.E.,	Baltimore, Md.
Adams, Robert Wilson,	E.M.,	Crafton.
Ancona, Frederick Bechtel,	E.E.,	Reading.
Appel, Carl Wilson,	E.E.,	Allentown.
Asbury, Thomas Henry,	Bus.,	Philadelphia.
Bahnsen, Conrad Mortimer,	B.A.,	Easton.
Balderson, Robert Power,	Bus.,	Pittsburgh.
Barber, Frederick Edwin,	E.E.,	Allentown.
Barrall, John Kenneth,	B.A.,	Allentown.
Barrell, Robert Webb, Jr.,	E.E.,	St. Louis, Mo.
Beale, Edward Belknap,	Ch.E.,	Washington, D. C.
Beck, Rodney Maurer,	Ch.E.,	Germantown.
Beitzel, Horace Clifton, Jr.,	M.E.,	Philadelphia.
Berry, Henry Parmentier,	E.E.,	Washington, D. C.
Bessemer, Steven Joseph,	Bus.,	Bethlehem.
Best, Ralph Walter,	E.E.,	Allentown.
Bieg, Henry Conrad,	E.M.,	Philadelphia.
Bishop, Charles Fletcher,	E.E.,	Williamsport.
Blankenbuehler, John Henry,	E.E.,	Elizabeth.
Bloch, Elmer Morton,	B.A.,	Newport, R. I.
Bodey, Carl Franklin,	E.E.,	Reading.
Borden, George Centennial, Jr.,	Ch.E.,	Asbury Park, N. J.
Boyd, James Andrew,	Bus.,	Montvale, N. J.
Boyden, Wilson Gordon,	E.E.,	Greenwich, Conn.
Boyer, Willard Albert Solomon,	B.A.,	Lehighton.
Bray, Lennox Jerome,	M.E.,	Westerly, R. I.
Brightbill, David Frantz,	E.E.,	Lebanon.
Brotzman, Reginald Philip,	E.E.,	Bethlehem.
Buckley, John Brooke,	N.E.,	Port Edwards, Wis.
Buller, William Earl,	Bus.,	Harrisburg.
Burgess, Charles Owen,	Met.,	Niagara Falls, N. Y.
Bush, Charles Roland, Jr.,	C.E.,	Washington, D. C.
Callahan, George White, Jr.,	C.E.,	Newport, R. I.

Camm, John Palmer,	E.M.,	Atlantic City, N.J.
Carey, James White, Jr.,	M.E.,	Wenonah, N. J.
Carlisle, William Albert,	E.E.,	Luthersburg.
Christman, Calvin Claude,	B.A.,	Lehighton.
Church, Allan Hudson,	Ch.E.,	Elizabeth, N. J.
Claxton, Robert Bethell, Jr.,	Bus.,	Beachwood, N. J.
Coleman, Douglas Fleming,	B.A.,	Jersey City, N. J.
Compher, Wilfred Clinton,	Bus.,	Poolesville, Md.
Conlin, John Francis,	Bus.,	Philadelphia.
Conroy, James Maurice,	B.A.,	Burlington, N. J.
Cornelius, George Emil Wagner,	Bus.,	McKeesport.
Cosh, William Harold,	C.E.,	Vineland, N. J.
Cox, Newton Perkins,	E.E.,	Philadelphia.
Coxe, Edward Haviland, Jr.,	E.E.,	Pittsburgh.
Craig, Thomas B.,	M.E.,	Slatington.
Creighton, Arthur Morgan,	Met.,	Bayonne, N. J.
Cusick, Arthur Cabot,	M.E.,	Roxbury, Mass.
Darsie, James Hazen,	E.M.,	West Homestead.
Davis, Edward Chester,	M.E.,	Taylor.
Davis, Norris Dungleison,	Bus.,	Conshohocken.
Davis, William Shaff, Jr.,	C.E.,	Lebanon.
Dawson, Henry Americus, Jr.,	Bus.,	Rockville, Md.
Decker, Everett Judd,	E.M.,	Mountain Lakes, N. J.
DeMoyer, Frank Hart,	C.E.,	Camden, N. J.
Denburger, Fred Herman,	C.E.,	Bethlehem.
DePuy, Stuart Walton,	Ch.E.,	Hammonton, N. J.
Derrick, Charles Luther,	E.E.,	Washington, D. C.
Desh, George Jacob,	B.A.,	Bethlehem.
Di Giulian, Attilio Peter,	C.E.,	Washington, D. C.
Dithridge, Edward Hay,	Ch.E.,	Morrisville.
Douglass, Leo Frederick,	Bus.,	Wakefield, Mass.
Douglas, Randolph Angus,	M.E.,	Plainfield, N. J.
DuBois, Howard Higbee,	C.E.,	Philadelphia.
Dynan, Harold Baker,	Met.,	Bethlehem.
Ekstedt, Oscar Carl,	B.A.,	Toledo, O.
Ellis, George Conkling,	Bus.,	Basking Ridge, N. J.
Erb, John Edgar,	Met.,	Middletown.
Ertner, Harold Sigmond,	C.E.,	Camden, N. J.
Eshbach, Truman Walter,	B.A.,	Bethlehem.
Fagan, Marvin Troy,	E.E.,	Weatherly.
Fancher, Charles Melvin,	N.E.,	Elizabeth, N. J.

Farace, Samuel,	E.E.,	Baltimore, Md.
Farkas, Harold,	Ch.E.,	Newark, N. J.
Fay, Frederick Hamilton,	Ch.E.,	Cranford, N. J.
Fehr, Howard Franklin,	B.A.,	Bethlehem.
Felmley, Charles Lauren,	E.E.,	Oldwick, N. J.
Ferguson, Frank Elliott, Jr.,	E.E.,	Plainfield, N. J.
Ferris, Edwin Alden,	M.E.,	Ridgefield Park, N. J.
Ferry, John Francis,	E.E.,	Allentown.
Fitch, Grant,	E.E.,	Washington, D. C.
Focht, Louis Doster,	E.M.,	Trenton, N. J.
Foot, Cyril Hughes,	M.E.,	Westfield, N. J.
Forney, Charles David,	E.E.,	Hanover.
Forstall, Charles Fletcher,	C.E.,	Rosemont.
Frazier, Donald Plumb,	Bus.,	Aurora, Ill.
Freeman, Calōs Alphonso,	E.M.,	Caracas, Venezuela.
Ganey, Thomas Vincent,	Bus.,	Bethlehem.
Garber, Meyer Isadore,	Ch.E.,	Norristown.
Gardy, Julian Washington,	Bus.,	Doylestown.
Garman, Edwin Lester Meckley,	Bus.,	Penbrook.
Gentzlinger, Henry Werner,	C.E.,	New York, N. Y.
Getz, David,	B.A.,	Allentown.
Gihon, Harry David,	M.E.,	Trenton, N. J.
Goldberg, Horace Harrison,	B.A.,	Jenkintown.
Graff, Richard Morris,	E.M.,	Worthington.
Graham, George Tinsley,	Bus.,	Bethlehem.
Green, Kenneth William,	E.E.,	Weissport.
Groff, Joseph Coblentz,	M.E.,	New York, N. Y.
Grundy, Park Alan,	Bus.,	New York, N. Y.
Guthrie, Nelson Rawlins, Jr.,	C.E.,	Baltimore, Md.
Hacker, Robert Trost,	E.M.,	Toledo, O.
Hafler, LeRoy Amandus,	C.E.,	Bingen.
Hagenbuch, Edward Allen, Jr.,	E.E.,	Allentown.
Hager, William Franklin,	Bus.,	Bethlehem.
Haldeman, Samuel Tyson,	N.E.,	Williamsport.
Hales, Ralph Alonzo,	Ch.E.,	Washington, D. C.
Hallihan, Edward Britt,	Bus.,	New York, N. Y.
Hardcastle, Edward,	E.E.,	Easton, Md.
Harkins, Linus Kenneth,	B.A.,	Homestead.
Harris, Thomas Wilson,	C.E.,	Athens.
Hartung, Philip Halstead,	M.E.,	Yonkers, N. Y.

Hauck, Adam Edward,	E.M.,	Buffalo, N. Y.
Heikes, George Conrad,	Met.,	Salt Lake City, Utah.
Hendrickson, Lynn Francis,	Ch.E.,	Woodbury, N. J.
Hicks, Albert Willet, Jr.,	E.M.,	Allentown.
Hiestand, John Engle,	Met.,	Bainbridge.
Hogg, Wallace Bruce,	Bus.,	Pittsburgh.
Hogue, Francis Herbert Kerr,	E.M.,	Philadelphia.
Hoke, William Mason,	E.E.,	Lebanon.
Hornbostel, Lloyd,	M.E.,	New York, N. Y.
Huggins, Georg Allen, 3d,	M.E.,	Brooklyn, N. Y.
Huston, James Stewart,	Met.,	Coatesville.
Israel, Charles Henry, Jr.,	Ch.E.,	Philadelphia.
Jacobson, Louis John,	C.E.,	Washington, D. C.
Johnson, Alfred William,	E.E.,	West Hartford, Conn.
Johnston, Byron Albert		
Chapman,	E.M.,	Tompkinsville, N. Y.
Kaman, Samuel,	B.A.,	New York, N. Y.
Kennedy, Jamieson Douglas,	B.A.,	North Adams, Mass.
Kiechel, Leonard David,	Bus.,	Northampton.
Klaas, Walter Ernest,	Bus.,	Montclair, N. J.
Klippel, Earl Frederick,	E.E.,	New York, N. Y.
Knodel, Charles Gotthilf,	M.E.,	Allentown.
Knouse, Walter Earl,	E.E.,	Washington, D. C.
Koch, George Schneider,	E.E.,	Washington, D. C.
Kocher, Walter Merritt,	C.E.,	Allentown.
Kofke, Charles Lewis,	Met.,	Philadelphia.
Kramer, Allan Reuel,	E.E.,	Coplay.
Kramer, Harold Kusel,	M.E.,	Brooklyn, N. Y. ,
Kravitz, Raphael,	C.E.,	Atlantic City, N. J.
Kreisel, John Werner,	B.A.,	Pen Argyl.
Kressler, Charles Horner,	E.E.,	Finesville, N. J.
Kurtz, Irwin Faust,	C.E.,	Pottstown.
Kutzleb, Richard, Jr.,	M.E.,	Baltimore, Md.
Lambert, Tilghman Albert,	B.A.,	Allentown.
Laufer, Harry Edgar,	Bus.,	Bethlehem.
Laughton, William Miller,	Met.,	Washington, D. C.
Lawrence, Ernest,	B.A.,	Bristol.
Lazarus, Franklin Thomas		
Wright,	Bus.,	Bethlehem.
Lebovitz, Samuel Llewellyn,	E.M.,	Baltimore, Md.

Lee, Ralph William, Jr.,	C.E.,	Washington, D. C.
Lees, John Luther,	C.E.,	Bethlehem.
Leister, Frank Henry, Jr.,	C.E.,	North Wales.
Lewis, Frederick William,	B.A.,	Pottsville.
Light, Joel Longnecker,	E.M.,	Allentown.
Light, Simon Peter, Jr.,	E.E.,	Lebanon.
Liveright, Henry, Jr.,	Ch.E.,	Clearfield.
Lodge, Friend Horace,	C.E.,	Philadelphia.
Lohmann, Louis John,	E.E.,	Scranton.
Loose, Henry Troxell,	Bus.,	Allentown.
Lyons, Grant Maxwell,	B.A.,	Warren.
McCarthy, Raymond Timothy,	Bus.,	Easton.
McConnell, George D.,	Bus.,	Butler.
McFadden, Michael Charles Joseph,	Met.,	Bethlehem.
McNulty, Carrell Stewart,	C.E.,	Washington, D. C.
McPherson, John Douglas, 3d.,	E.E.,	Fair Oaks, Cal.
Magruder, Elbert Tyler,	M.E.,	Winchester, Va.
Mecasin, Harry Benton, Jr.,	E.E.,	Baltimore, Md.
Meyer, Theodore Henry,	M.E.,	Newark, N. J.
Millar, Glenn Leroy,	M.E.,	Ensley, Ala.
Miller, Charles Heck,	Ch.E.,	Wilkes-Barre.
Minnich, Charles Raymond,	C.E.,	Robesonia.
Minnich, Joseph Pilkay,	E.E.,	Harrisburg.
Miszkiel, Victor S.,	E.E.,	Ashley.
Mitman, Frederick Snyder,	E.M.,	Bethlehem.
Mitman, Harry Ammon,	Ch.E.,	Northampton.
Molloy, James Xavier,	N.E.,	Bridgeport, Conn.
Moyer, Joseph Fretz,	C.E.,	Quakertown.
Muirhead, Andrew Wilson,	M.E.,	Bridgeport, Conn.
Muschlitz, Wilbert David,	B.A.,	Bethlehem.
Mutch, Thomas Sangster,	E.M.,	Bryn Mawr.
Muzdakakis, John Robert,	M.E.,	Baltimore, Md.
Nadig, Stanton Elwell,	N.E.,	Allentown.
Nevins, Samuel Craig,	Ch.E.,	Tamaqua.
O'Donnell, Thomas Alfonsus,	B.A.,	Eckley.
O'Keefe, Francis Callistus,	Bus.,	Rockville, Conn.
Olcott, John Hedrick,	C.E.,	Glencarlyn, Va.
Old, Marcus Calvin,	B.A.,	Allentown.
Opdycke, John Hinkle,	Bus.,	Philadelphia.

Orlando, Samuel Palella,	E.E.,	Bridgeton, N. J.
Palmer, Henry Parsons,	C.E.,	Langhorne.
Passmore, Henry Etter, Jr.,	M.E.,	Columbus, O.
Patterson, Robert Livingston, Jr.,	Ch.E.,	Elizabeth, N. J.
Petersen, Theodore Otto,	Ch.E.,	Philadelphia.
Pfahler, Robert Gair,	E.M.,	Wilkes-Barre.
Philippides, John Argyrios,	B.A.,	Athens, Greece.
Picht, George Christopher, Jr.,	E.E.,	Bethlehem.
Pierce, Jonathan Dorr,	Bus.,	Montclair, N. J.
Piersol, John,	M.E.,	Philadelphia.
Pill, Frank, Jr.,	B.A.,	Califon, N. J.
Platt, Robert,	Ch.E.,	Westfield, N. J.
Plumb, Rollo Green,	B.A.,	Bethlehem.
Quick, Donald Mott,	M.E.,	Yonkers, N. Y.
Quier, Kenneth Elwell,	M.E.,	Bethlehem.
Quigley, Raymond Joseph,	Ch.E.,	Jeddo.
Randall, Harradon R.,	C.E.,	Shamokin.
Randall, Nathaniel Gilroy,	Bus.,	Hanover.
Read, John Mason,	C.E.,	Washington, D. C.
Redington, Joseph Patrick,	Bus.,	Wilkes-Barre.
Regad, Eugene Desire,	E.E.,	Irvington, N. J.
Reid, Byron G.,	B.A.,	Hartford, Conn.
Reif, Fulmer Jacob, Jr.,	Ch.E.,	Harrisburg.
Reiter, Irvin Sterner,	Met.,	Bethlehem.
Reynolds, Joseph Lee,	M.E.,	Dorranceton.
Rhoades, Ronald Sags,	E.M.,	Nutley, N. J.
Rhode, Harold Cyrus,	E.M.,	Kutztown.
Richards, Elmer Lincoln, Jr.,	C.E.,	Somerville, N. J.
Rieman, Edwin Frederick,	E.E.,	Tamaqua.
Riley, John Stephen,	E.E.,	Willimantic, Conn.
Roberts, Evan Emlyn,	M.E.,	Dunmore.
Robinson, John Bunyan,	E.M.,	Chester.
Robnett, John David, Jr.,	E.E.,	Washington, D. C.
Rodgers, Samuel Procter,	M.E.,	Baltimore, Md.
Rodriguez, Abraham,	C.E.,	Chapparral, Tulima, Colombia, S. A.
Roller, Oscar Frederic, Jr.,	Ch.E.,	Philadelphia.
Roney, David Martin,	Bus.,	Philadelphia.
Roth, Leonard William,	Bus.,	Philadelphia.

Ruger, Raymond Philip,	C.E.,	Philadelphia.
Sansom, Edward Marsh,	Ch.E.,	Cranford, N. J.
Saunders, Oliver Hubbard, Jr.,	M.E.,	Brooklyn, N. Y.
Schaefer, Everett Gordon,	Ch.E.,	New York, N. Y.
Scheirer, Charles Worthington,	Ch.E.,	Jonestown.
Schifreen, Clement Solomon,	E.E.,	Catasauqua.
Schragger, Charles Nelson,	Ch.E.,	Trenton, N. J.
Schrauff, Henry John,	C.E.,	Jersey City, N. J.
Schwab, Thomas Wesley, Jr.,	B.A.,	Bath.
Schwarzbach, Alvin August		
Claus,	E.M.,	Newark, N. J.
Scofield, Edmond Preston,	Ch.E.,	Bayonne, N. J.
Sehring, Fred George,	B.A.,	Joliet, Ill.
Settle, Richard Torpin,	Ch.E.,	Drexel Hill.
Shaw, Hugh Curtis,	Bus.,	Tidioute.
Sheedy, Clayton McGowan,	Bus.,	Groton, Mass.
Sheetz, Olin Curtis,	Met.,	East Stroudsburg.
Shelly, Freeman Moyer,	Bus.,	Allentown.
Shoemaker, H. E. Walter,	C.E.,	Freeland.
Shoemaker, Lewis Foulke, Jr.,	C.E.,	Devon.
Siemann, Arthur Louis,	C.E.,	Brooklyn, N. Y.
Smith, Leslie Ewart,	E.M.,	East Mauch Chunk.
Smith, Thomas Cameron,	M.E.,	Allentown.
Snyder, Edwin Henry, Jr.,	E.E.,	Washington, D. C.
Spindler, Henry,	M.E.,	Jersey City, N. J.
Sprague, John Frederick,	M.E.,	Raleigh, N. C.
Stafford, Samuel Alfred,	Met.,	Coraopolis.
Stanier, John Stewart,	Bus.,	Tarentum.
Stanley, Leslie Wright,	B.A.,	Williamsport.
Steiner, William Joseph Henry,	Bus.,	New York, N. Y.
Stanton, Thomas William,	Bus.,	Newark, N. J.
Stoll, John Howard,	Met.,	Bethlehem.
Sylvan, Rolf,	Bus.,	Montclair, N. J.
Talmage, Herbert Richard,	C.E.,	Irvington, N. J.
Taylor, John Wright, Jr.,	M.E.,	Century, Fla.
Taylor, Thomas Rogers,	Ch.E.,	Palmyra, N. J.
Thomas, Hopkin Buckland,	M.E.,	Catasauqua.
Thomas, John Archibald,	E.M.,	Helen, W. Va.
Thompson, William Gardiner,	C.E.,	Richmond Hill, N. Y.
Todd, James Arnold,	Ch.E.,	Doylestown.
Trumbore, Frederick William,	M.E.,	Bethlehem.

Tullidge, George Bowler, Jr.,	M.E.,	Philadelphia.
Turner, Clarence Hutchins,	E.E.,	Schenectady, N. Y.
Underwood, Herbert Francis,	M.E.,	Brooklyn, N. Y.
Van Billiard, Lewis Howard,	E.E.,	Elizabeth, N. J.
Van Keuren, Edwin,	B.A.,	Bethlehem.
Van Ness, John Harold,	C.E.,	Paterson, N. J.
Vilotti, James Victor,	Bus.,	Philadelphia.
Voss, Charles Abbott,	Bus.,	Brooklyn, N. Y.
Wallace, Edward Allen, Jr.,	Bus.,	Grand Rapids, Mich.
Walters, Frank Clayton,	B.A.,	Bethlehem.
Walton, Joseph Edward,	C.E.,	Bethlehem.
Warriner, Farnham,	Bus.,	Philadelphia.
Way, William Henry,	M.E.,	Coatesville.
Webb, Robert Stanford,	M.E.,	Asheville, N. C.
Wells, George Herbert, Jr.,	Ch.E.,	Brooklyn, N. Y.
Wentling, Lee Grant,	M.E.,	Conshohocken.
Wentz, James,	Bus.,	New York, N. Y.
Werft, Ellis Lincoln,	E.M.,	Altoona.
Werner, David Thomas,	E.E.,	Lebanon.
Wight, Donald Miller,	M.E.,	Washington, D. C.
Wilkins, Paul Edwin,	C.E.,	Baltimore, Md.
Wilson, Edwin Franklin,	E.E.,	Gastonville.
Wilson, Frederic William, Jr.,	E.E.,	Pocomoke, Md.
Wilson, Samuel Marshall,	Bus.,	Glenside.
Wingate, Bruce Kuglow,	C.E.,	Reading.
Wire, Charles Raymond,	C.E.,	Washington, D. C.
Wolensky, Barney Louis,	Bus.,	Palmerton.
Wright, Frederic Flavel,	Bus.,	Harrisburg.
Wuethrich, Adolph Gustave,	Met.,	Perth Amboy, N. J.
Young, Harry Elmer,	Ch.E.,	Atlantic City, N. J.
Yott, George Malcolm Doge,	Bus.,	New York, N. Y.
Zantzing, Richard Chew,	Bus.,	Washington, D. C.

FRESHMAN CLASS

Class of 1924

	COURSE	RESIDENCE
Abel, David Heaton,	B.A.,	Philadelphia.
Abel, George Justin,	E.E.,	Elizabeth, N. J.
Adams, Edgar Thomas, Jr.,	E.M.,	Crafton.
Alex, Joseph Leonard,	E.E.,	Shenandoah.
Alford, Charles Mahin,	E.E.,	East Orange, N. J.

Allan, Robert Houston,	Bus., Jermyn.
Alwine, Charles Emory,	E.E., New Oxford.
Anderson, Lansdell,	E.E., New York, N. Y.
Andrews, Walter Crane,	Bus., Newark, N. J.
Angulo, Antonio,	M.E., Barranquilla, Colombia, S. America.
Angulo, Isaac Carlos,	Ch.E., Barranquilla, Colombia, S. America.
Arter, Adelbert Allison,	E.M., Youngstown, O.
Arthurs, Biddle,	E.E., Pittsburgh.
Atwood, Henry Martyn,	B.A., Buffalo, N. Y.
Ayers, William DeWitt,	C.E., Branchville, N. J.
Baker, Ernest Wellington,	E.E., Harrisburg.
Barton, Frederic Charles, Jr.,	E.E., Tenafly, N. J.
Bastian, Frank Joseph,	M.E., Mahanoy City.
Bechtel, Edward Jacob,	M.E., Maywood, N. J.
Beckman, George William,	M.E., Hellertown.
Beech, Rozier James,	Bus., Washington, D. C.
Bell, George Howard,	Bus., Canton, O.
Bell, Harry Stanton,	Bus., Spartanburg, S. C.
Bell, Raymond Milton,	Bus., Philadelphia.
Benner, Ralph Chalfont,	M.E., Atglen.
Bennett, Edmund Van Gilder,	Met., Lansdale.
Berg, Frederick Christian,	N.E., Philadelphia.
Bergen, Howard Beekman,	E.E., Newtown.
Bishop, Morris Earl,	B.A., Bethlehem.
Black, John Murray,	M.E., Buffalo, N. Y.
Blake, Alfred Green,	M.E., Pittsburgh.
Blakeley, George Bogart,	Bus., Bethlehem.
Blessing, Raymond Joseph,	Ch.E., Reading.
Boggs, George Warren,	Bus., Philadelphia.
Bond, Frank Edward, Sr.,	B.A., Woburn Sands, Bucks, England.
Bond, Louis Boutell,	M.E., Ashbourne.
Bond, Luther Gerrert,	M.E., York.
Bonney, Henry Ernest,	B.A., Pen Argyl.
Bortz, Carl Martin,	Bus., Pittsburgh.
Botzer, James Patrick,	Ch.E., Johnsonburg.
Boyle, Joseph,	Bus., Paterson, N. J.
Bradley, Clifton Newton,	Bus., Brooklyn, N. Y.
Bridgman, Warren James,	E.E., Reading.

Britt, Therman Paul,	Bus.,	Abington.
Brown, Charles Daniel,	M.E.,	Altoona.
Brownmiller, Lorrin Thomas,	Chem.,	Shoemakersville.
Buck, Richard Joseph,	B.A.,	Bethlehem.
Buckbee, Henry Wisner,	C.E.,	Wisner, N. Y.
Buechley, Frank Seltzer,	Bus.,	Pottsville.
Bugbee, Jesse Albert,	C.E.,	Trenton, N. J.
Bullock, Richard Hunt Downing,	E.E.,	Philadelphia.
Bumbaugh, Frank Taylor,	Met.,	Monessen.
Burdick, William Foster,	B.A.,	Uniondale.
Burt, Paul Shafter,	Bus.,	East Stroudsburg.
Campbell, Paul Frederick,	C.E.,	Swedesboro, N. J.
Campbell, William Brunner,	Bus.,	Lebanon.
Canavan, William Paul,	B.A.,	Chester.
Carol, Jose Maria,	C.E.,	Cardenas, Cuba.
Carpenter, Harry Bartleson, Jr.,	M.E.,	Montclair, N. J.
Carter, Norman Campbell,	Ch.E.,	Phoenixville.
Chamberlin, Alan Charles,	B.A.,	Bethlehem.
Chang, Kuang-Ming,	Met.,	Shanghai, China.
Chew, Robert Zent,	Bus.,	Fredericktown, O.
Childs, Frank Lawton,	Bus.,	New York, N. Y.
Cioffi, John Mathew,	Bus.,	New York, N. Y.
Clark, John Edmund Duncan,	M.E.,	Wilmington, N. C.
Clemmer, Stanley Bachman,	Ch.E.,	Allentown.
Cluthe, Carl, 3rd,	Bus.,	Glen Ridge, N. J.
Coleman, Spencer Albert,	Met.,	Cleveland, O.
Conley, Thomas George, Jr.,	Bus.,	Pittsburgh.
Cook, Roland Fuller,	M.E.,	Glen Ridge, N. J.
Cornelius, Charles Taylor,	M.E.,	Pittsburgh.
Cousens, Harold Franklin,	Bus.,	Arlington, Mass.
Cramer, William Aurelius		
Wrenn,	N.E.,	Suffolk, Va.
Crawford, David William,	E.E.,	Scranton.
Crawford, Frederick Rufus,	M.E.,	McKeesport.
Crick, Linville Hamilton, Jr.,	Met.,	Pittsburgh.
Croft, Samuel, 2nd,	Bus.,	Philadelphia.
Cupp, Laylon Lavern,	M.E.,	Williamsport.
Davidson, Jacob Israel,	E.E.,	Baltimore, Md.
Davidson, Stuart Ross,	E.M.,	Elizabeth, N. J.
Dawson, Walter Williams,	Bus.,	Rockville, Md.
Degnan, James Michael, Jr.,	E.E.,	Bethlehem.

DeTurk, Wilbur Charles,	M.E.,	Cape May, N. J.
DiBiase, Claude,	Bus.,	Newark, N. J.
DiBiase, James,	Bus.,	Newark, N. J.
Dick, Arthur Ellsworth, Jr.,	Bus.,	Hazleton.
Dick, Donald Benner,	Bus.,	Hazleton.
Dickinson, Ansel Reed,	E.E.,	New Haven, Conn.
Diener, Walter Miller,	M.E.,	Hamburg.
Dietrick, Robert Charles,	B.A.,	High Bridge, N. J.
Dietz, Joseph Budding,	Ch.E.,	Lancaster.
Dixon, Henry Marshall,	Ch.E.,	Washington, D. C.
Donaldson, Kenneth,	C.E.,	Washington, D. C.
Douglass, Norman Engleman,	Ch.E.,	Bethlehem.
Downey, Robert Arthur, Jr.,	Bus.,	Oswego, N. Y.
Drake, William Robert,	C.E.,	Reading.
Durkin, John Keenan,	E.M.,	West Pittston.
Edson, Warren Newton,	M.E.,	Scranton.
Eichelberger, William Sweet,	E.M.,	Saxton.
Emanuel, Robert Samuel,	M.E.,	Nesquehoning.
Ennis, Robert William,	C.E.,	Reading.
Eskew, Arthur Howell,	B.A.,	Asbury Park, N. J.
Evans, Earl Bertram,	C.E.,	Pageton, W. Va.
Fallon, Bernard,	Bus.,	Hartford, Conn.
Feick, Rufus Daniel,	Ch.E.,	Kutztown.
Feuille, Harlan,	C.E.,	Ancon, Panama.
Fink, Donald Goodenough,	Bus.,	Reading.
Fisher, Craig Royston,	B.A.,	Newburyport, Mass.
Fleck, Paul Butler,	E.M.,	Pittsburgh.
Foster, Arthur Lee,	E.E.,	Scranton.
Fox, Edward George,	E.M.,	Pottsville.
Frankois, Joseph,	M.E.,	Nanticoke.
French, Samuel Hooker,	M.E.,	Woodstown, N. J.
Fritzsche, Otto Herbert Adolph,	C.E.,	Irvington, N. J.
Fritz, Donald Wilson,	Bus.,	East Orange, N. J.
Fugate, Howard,	B.A.,	Easton.
Fulmer, Donald Book,	Met.,	Coatesville.
Gallagher, Charles Barto,	B.A.,	Asbury Park, N. J.
Galloway, Beverly Stewart,	B.A.,	Takoma Park, D. C.
Garbarino, Stephen Lawrence,	Bus.,	Shenandoah.
Garcia, Julio Anfonso,	C.E.,	New York, N. Y.
Garra, Edward Joseph,	E.E.,	White Haven.
Gee, Elisha, Jr.,	B.A.,	Denver, Col.

Geho, Charles Henry,	Ch.E.,	Allentown.
Genshart, Fred William Kriebel,	E.M.,	East Mauch Chunk.
Gerhart, Paul Leroy,	E.E.,	Reading.
Gilmour, Edward Holford,	M.E.,	Philadelphia.
Good, Robert Dewalt,	E.M.,	Alelntown.
Gorham, Edward Werrey,	Ch.E.,	Brooklyn, N. Y.
Gorman, Joseph Francis, Jr.,	M.E.,	Allentown.
Gould, Edson Beers, Jr.,	N.E.,	Asbury Park, N. J.
Grace, Carroll Brewster, Jr.,	M.E.,	Philadelphia.
Graessle, Frederick Eugene,	Bus.,	Brooklyn, N. Y.
Graff, Thomas Johnson,	M.E.,	Greenville.
Grambs, George Lorenzo,	B.A.,	Scranton.
Gray, George, Jr.,	M.E.,	Philadelphia.
Greacen, Walter, 3rd,	Bus.,	East Orange, N. J.
Greer, Harry Ross,	B.A.,	Atlanta, Ga.
Grim, James Stewart, Jr.,	E.E.,	Kutztown.
Haefeker, George Augustus,	Ch.E.,	Tamaqua.
Hampton, George,	Ch.E.,	Bridgeton, N. J.
Hanna, William McAfee,	E.E.,	Washington, D. C.
Harman, Edward Hosfield,	E.E.,	New York, N. Y.
Harper, Robert Malcolm,	Bus.,	Butler.
Harris, Frank Leslie,	Met.,	Wilmington, Del.
Harris, Howard Yeager,	B.A.,	Dorranceton.
Hartzell, Richard Wilson,	Met.,	Allentown.
Hauser, Roderick Ritter,	Bus.,	Allentown.
Hauser, Stanley LeRoy,	Met.,	Kutztown.
Hawkins, Richard Arthur,	E.M.,	Forty Fort.
Heckert, Robert Augustus,	B.A.,	Brackenridge.
Heimbrook, Charles Albert,	Bus.,	Bethlehem.
Heller, Clifford Francis,	C.E.,	Stroudsburg.
Henry, Eugene Harvey,	C.E.,	Lancaster.
Henzelman, Carl Franklin,	Bus.,	Easton.
Heske, Walter Gottlieb,	Met.,	Bethlehem.
Hewson, Edward Hashell,	N.E.,	Madison, N. J.
High, Byron Gilbert,	E.E.,	Pottstown.
Hoagland, Dan Parmlee, Jr.,	B.A.,	Bayonne, N. J.
Hoffman, William Jacob,	B.A.,	Raubsville.
Hohl, Joseph Louis,	E.M.,	Catasauqua.
Homeyer, William Henry,	B.A.,	Jersey City, N. J.
Hopkins, John William,	C.E.,	Ambler.
Horton, Ralph Durling,	M.E.,	Andover, N. J.

Hottinger, Alwin Julius,	Met.,	Kenil, N. J.
Houser, William Earl,	B.A.,	Middletown.
Howser, Sellman,	Ch.E.,	Baltimore.
Huff, Thomas Daniel,	M.E.,	New York, N. Y.
Huggins, William Grenell,	Bus.,	Adams, N. Y.
Hughes, Guy Ingersoll,	Bus.,	Elizabeth, N. J.
Hunter, Francis Alexander,	M.E.,	Hoboken, N. J.
Hutnik, George Joseph,	E.E.,	Wilkes-Barre.
Jamieson, John Jay Ivory,	Met.,	Frackville.
Jamison, Earl Helmes,	E.E.,	Hazleton.
Jenkins, George French,	E.M.,	Binghamton, N. Y.
Jenkins, Mitchell Young,	Ch.E.,	Hanover.
Johnson, Sidney Edward,	Bus.,	Dayton, O.
Jones, George Tyron,	B.A.,	Edwardsville.
Jones, William Harold, Jr.,	Ch.E.,	Asheville, N. C.
Kasper, Ralph Joseph,	N.E.,	Ridgefield, Conn.
Kavanagh, Charles Thomas,	B.A.,	Bayonne, N. J.
Kean, James Gregory,	N.E.,	Lansdowne.
Keefer, Samuel Mumber,	E.E.,	Danville.
Keller, Edwin Walker,	Bus.,	Allentown.
Kemmerer, Walter William,	B.A.,	Wind Gap.
Kerlin, Jackson Lantz,	E.M.,	Philadelphia.
Kichline, William Levi,	B.A.,	Bethlehem.
Kiefer, Hermán Eugene, Jr.,	C.E.,	Quincy, Ill.
Kinney, Joseph Francis, Jr.,	Bus.,	Bethlehem.
Kirchner, Christian,	N.E.,	Baltimore, Md.
Kirchner, Earl Lorenz,	Ch.E.,	Washington, D. C.
Kitchen, John C., Jr.,	Ch.E.,	Columbia, N. J.
Klein, Walter Conrad,	B.A.,	Pottsville.
Klock, John Bees,	E.E.,	Shenandoah.
Kniley, Clifford Leroy,	Bus.,	Tower City.
Koller, Charles Oliver,	E.M.,	New Freedom.
Kern, Raymond Jonas,	M.E.,	Allentown.
Kratz, William,	M.E.,	Baltimore, Md.
Langfitt, James Porter,	B.A.,	Parkersburg, W. Va.
Lau, Zau Ji,	Ch.E.,	Shanghai, China.
Ledoux, Leonard K.,	M.E.,	Swarthmore.
Lee, Charles Benjamin,	Bus.,	Glen Jean, W. Va.
Leh, James Alfred,	Ch.E.,	Catasauqua.
Lester, Harry Vanderburgh,	Ch.E.,	Harrisburg.
Levy, Bertram Rich,	E.E.,	Brooklyn, N. Y.

Lewis, John Herbert,	C.E.,	North Wales.
Light, Berlin Carl,	Ch.E.,	Reading.
Light, Herman Kreider,	N.E.,	Lebanon.
Linaberry, Stanley Simrell,	C.E.,	Columbia, N. J.
Lindo, Donald Joseph,	M.E.,	East Orange, N. J.
Lingle, Charles Fitting,	Bus.,	Harrisburg.
Litke, Harry Theodore,	C.E.,	Millville, N. J.
Lobach, Harry Reginald,	Ch.E.,	Allentown.
Lock, Robert Kenneth,	Met.,	Ashtabula, O.
Logan, Curtis Passavant,	M.E.,	Forty-Fort.
Long, Willoughby James,	Met.,	Bethlehem.
Lord, Edward Thomas Warren,	Ch.E.,	Philadelphia.
Lozano, Hector,	Ch.E.,	Nuevo Leon, Mexico.
Luce, Donald Cameron,	E.E.,	Scranton.
Lundberg, George Otto,	M.E.,	Lansing, Mich.
Lutz, James Frank,	Bus.,	Hazleton.
Lynch, Frank Elijah, Jr.,	M.E.,	Delmar, Del.
MacKenzie, Adrian Morell,	Bus.,	Englewood, N. J.
McBride, John Leo,	B.A.,	Phillipsburg, N. J.
McBride, Joseph Aloysius,	M.E.,	Philadelphia.
McCartney, John Lincoln, Jr.,	Bus.,	Crafton.
McElvain, Clarence Newton,	Bus.,	Red Oak, Ia.
McFadden, John Joseph,	E.E.,	Allentown.
McIntire, Robert Lester,	M.E.,	Butler.
Mack, Edwin Laverne,	E.E.,	Allentown.
Mackenzie, Sidney Thompson,	N.E.,	Philadelphia.
Maguire, Joseph Anthony,	B.A.,	Vineland, N. J.
Major, William Samuel,	Ch.E.,	Roebling, N. J.
Malloy, Daniel Joseph,	B.A.,	Freeland.
Mandell, Leon Nathaniel,	Ch.E.,	Philadelphia.
Manley, Herbert Waldo,	B.A.,	Canton.
Mann, Morgan MacMorries,	Met.,	New York, N. Y.
March, Eugene Royer,	Bus.,	Philadelphia.
Markle, Oswald Luke,	Ch.E.,	Hanover.
Martin, Frederic Thurman,	Ch.E.,	Harrisburg.
Master, Warren S.,	E.E.,	Reading.
Maust, George Johnson,	Bus.,	St. Augustine, Fla.
Melniker, Edward Joseph,	B.A.,	Bayonne, N. J.
Metzner, Russell Henry,	M.E.,	Wheeling, W. Va.
Meyer, William Charles,	E.E.,	Bethlehem.
Miller, Philip Robert,	B.A.,	Bethlehem.
Miller, Walter Hurxthal, Jr.,	E.M.,	Glendale, O.

Milligan, John Ralph,	Bus.,	East Liverpool, O.
Minister, Pemberton Foster,	B.A.,	Bristol.
Mitchell, Charles Bayard,	E.M.,	Woodbury, N. J.
Mixsell, Edwin Leighton,	Met.,	Bethlehem.
Moore, Myron T.	Bus.,	Youngstown, O.
Moorhead, Albert Donald,	Met.,	Indiana.
Morgan, Josiah Dodson,	E.E.,	Reading.
Myers, John Alfred,	M.E.,	York.
Neely, Curll Lockwood,	Ch.E.,	Foxburg
Newell, Howard Laurens,	Bus.,	West Carrolton, O.
Newhard, Paul Aaron,	Bus.,	Northampton.
Northup, Maynard Sanbon.	Met.,	Allentown.
Nuss, Raymond Victor,	C.E.,	Bethlehem.
O'Brien, William Henry,	Bus.,	Lynbrook, N. Y.
Palmer, William Francis,	Ch.E.,	Reading.
Panckere, Francis Joseph,	E.M.,	Lansford.
Parker, Joseph Henry,	Bus.,	Milwaukee, Wis.
Parker, William Alden,	M.E.,	Haverford.
Parsons, Donald Adelbert,	M.E.,	New Rochelle.
Patterson, Daniel Walter,	C.E.,	Bethlehem.
Patterson, John Alexander,	Ch.E.,	Philadelphia.
Paxton, George Benjamin,	E.E.,	Harrisburg.
Pearson, Frederick Joseph,	B.A.,	Wilkes-Barre.
Penwell, Max Kenneth,	E.M.,	Pana, Ill.
Person, Wilbur William,	E.M.,	Weissport.
Phillips, Hugh Joseph,	C.E.,	Red Bank, N. J.
Pierson, Albert Closson,	B.A.,	Lititz.
Platt, Ellis Halsted,	Bus.,	Bethesda, Md.
Pomfret, Robert Wallace,	M.E.,	Richmond Hill, N. Y.
Poor, Arthur Grimes,	E.E.,	Passaic, N. J.
Quinlan, Eldridge Edward,	Bus.,	Newark, N. J.
Ratajczak, Frank Xavier,	B.A.,	Reading.
Reams, Louis Milton,	M.E.,	Richmond, Va.
Reese, Benjamin Harvey,	N.E.,	Dorranceton.
Reilly, John Kennedy,	Bus.,	Spangler.
Reyer, William Aaron,	Ch.E.,	Northampton.
Rice, Charles Lewis,	C.E.,	Hazleton.
Rice, Janvier Mayhew,	M.E.,	Bridgeton, N. J.
Rich, Bernard Arthur,	E.E.,	Harrisburg.
Richards, Louis Moore,	M.E.,	Somerville, N. J.
Richardson, Edward Hardy,	C.E.,	Malvern.

Ritter, Ralph Shelly,	M.E.,	Quakertown.
Roberts, Arthur Parsons,	Bus.,	Englewood, N. J.
Robinson, Edmund Lewis,	E.E.,	Bethlehem.
Robinson, Harry George,	M.E.,	Trenton, N. J.
Robinson, John Mealy,	M.E.,	Pittsburgh.
Robinson, James Wood,	E.M.,	Shanghai, China.
Rogers, Henry Gordon,	Ch.E.,	Newark, N. J.
Rogers, John Frederick,	Bus.,	Buffalo, N. Y.
Rohrbach, Kenneth Loris,	Ch.E.,	Bethlehem.
Rohrer, Henry Augustus,	M.E.,	Lancaster.
Ross, Jack Elton,	C.E.,	Newark, N. J.
Roth, Harry Levyston,	Ch.E.,	Allentown.
Roth, Milton Samuel,	M.E.,	Butler.
Rouch, Ernest Allen,	M.E.,	York.
Russell, Charles Ellis,	E.E.,	Philadelphia.
Ruttenberg, Benjamin F.	Bus.,	Reading.
Ryan, Michael Joseph, Jr.,	Met.,	Bethlehem.
Sanchez, Waldino Diaz,	E.M.,	Bethlehem.
Sanford, James Leo,	C.E.,	Long Beach, N. Y.
Sattenstein, Sidney Lincoln,	E.E.,	Reading.
Sayre, Austin Bartholomew,	C.E.,	Glen Ridge, N. J.
Schaeffer, Harry Joseph,	Ch.E.,	Bethlehem.
Schaffer, George Washington,	Met.,	Allentown.
Scheetz, Edwin Freed,	E.M.,	Wyncote.
Schleicher, Wallace Mengel,	N.E.,	Maplewood, N. J.
Schlegel, Arthur Ordmon,	M.E.,	Reading.
Schoenfeld, Lester Wolfson,	E.E.,	Philadelphia.
Schreier, Harry,	Bus.,	New York, N. Y.
Schuler, Norman Edward,	Met.,	Bethlehem.
Schultz, Albert Novinger,	E.E.,	Williamsport.
Schwartz, Paul Englebert,	Bus.,	Harrisburg.
Scott, William Alexander,	N.E.,	New York, N. Y.
Seem, John Derr,	Met.,	Allentown.
Seideman, Sidney,	Bus.,	Philadelphia.
Serfass, Clayton Adam,	M.E.,	Colebrook, N. H.
Sheaffer, Amos Paul,	M.E.,	Lancaster.
Sheldon, Alan Forbes,	M.E.,	New Rochelle, N. Y.
Shields, Donald Sloan,	Bus.,	Ridgewood, N. J.
Shigo, John Joseph, Jr.,	B.A.,	Freeland.
Sidler, Robert Simington,	E.M.,	Sunbury.
Simmons, John Stegner,	E.M.,	Scranton.

Simpson, Harold Emerson,	Bus., Indiana.
Skolnick, Leonard,	Chem., Newark, N. J.
Smith, Theodore Boyd,	E.M., Middletown, N. Y.
Snyder, Frederick Deppen,	Ch.E., Harrisburg.
Snyder, Gehrad, 3rd,	Met., Bloomsburg.
Sobel, Sidney Amos,	Bus., Erie.
Springsteen, Arthur W.,	B.A., Detroit, Mich.
Springsteen, William,	Bus., Detroit, Mich.
Stahl, Frederick Glenn,	E.E., Bethlehem.
Stauffer, Edwin Lewis,	Ch.E., Northampton.
Stelle, Kenneth Lawrence,	E.M., Jamaica Plain, Mass.
Stern, Paul Hertzler,	B.A., Elizabethtown.
Stille, Francis Carroll,	E.M., Woodbury, N. J.
Straub, Lewis Boyd,	Bus., Pittsburgh.
Strawn, Eli Howard,	C.E., Quakertown.
Sutherland, Falkner,	Bus., LeRoy, N. Y.
Swartley, John Cassel, Jr.,	B.A., Doylestown.
Swartz, Ralph Christian,	M.E., Allentown.
Tatum, Chauncey Roland,	M.E., Baltimore, Md.
Tenney, Edward Andrews,	C.E., Vineland, N. J.
Thompson, Edward King,	M.E., Pittsburgh.
Thompson, John Shirreffs,	B.A., Auburn.
Thompson, Walter Scott,	E.E., Sunbury.
Thorp, Leo Joseph,	M.E., Rockville Centre, N. Y.
Tinsman, Howard Riegel,	M.E., Phillipsburg, N. J.
Toms, Charles Lawrence,	Ch.E., Morristown, N. J.
Tonking, Russell,	Ch.E., Dover, N. J.
Tremaine, Lawrence,	M.E., Buffalo, N. Y.
Troland, Hugh Moore, Jr.,	C.E., Philadelphia.
Troutman, Roy Ezra,	Ch.E., Tulpehocken.
Tuggey, John Mitchell, Jr.,	B.A., Bethlehem.
Underwood, Lloyd Fletcher,	Ch.E., Brooklyn, N. Y.
Underwood, Ralph Edward,	M.E., Brooklyn, N. Y.
Unkles, John Jacob,	Bus., East Orange, N. J.
Urban, Stanley Joseph,	E.M., Allentown.
Van Dyke, John Harrison,	M.E., Pittsburgh.
Vines, Norman Bowden,	Ch.E., New York, N. Y.
Waller, John Felix,	Ch.E., Allentown.
Walter, Ephraim Kenneth,	Bus., Brooklyn, N. Y.
Warriner, Ruel Dexter,	E.M., Philadelphia.
Wasser, Floyd Henry,	Met., Bethlehem.

Watkins, John Edward,	M.E.,	West Hazleton.
Wehr, Mentzer Russell,	E.E.,	Denver.
Wentz, Graham,	Ch.E.,	Scranton.
White, Charles McCrea,	C.E.,	Wilmington, Del.
Wiegner, Andrew Newton,	C.E.,	Bethlehem.
Wigfall, Edward Newton, Jr.,		Philadelphia.
Wilbur, Warren Packer,	C.E.,	Bethlehem.
Wilkins, Julian Chapman,	C.E.,	Baltimore, Md.
Wing, Francis Henry,	Bus.,	Boston.
Wise, James Andrew,	B.A.,	Hopeville, Ga.
Wood, Arthur,	B.A.,	Providence, R. I.
Wood, Charles Bradley,	N.E.,	Bellevue.
Wood, Frederic Turnbull,	Ch.E.,	Philadelphia.
Woodford, Walter Fletcher,	E.E.,	Nutley, N. J.
Woodrow, Maurice O.,	C.E.,	Wilkes-Barre.
Woolridge, William Porter,	M.E.,	Pittsburgh.
Yates, Richard Crawford,	Bus.,	Buffalo, N. Y.
York, Elbert Hower,	E.E.,	Scranton.
York, Warren Webster,	Bus.,	Scranton.
Yu, Chia-Ku,	E.E.,	Kiangsi, China.
Yundt, George Edward,	E.M.,	Allentown.
Zannaras, John Philippe,	N.E.,	Chios, Greece.
Zantzinger, Otway Berryman, Jr.,	Bus.,	Hyattsville, Md.

SPECIAL STUDENTS

	COURSE	RESIDENCE
Beatty, Seth Keeney,	Bus.,	Wilkes-Barre.
Benz, Paul Frederick,	Ch.E.,	Haledon, N. J.
Daughtrey, Guy Darrell,	N.E.,	Waco, Tex.
Goldberg, Solomon,	Chem.,	Pilwischky, Russia.
Hsu, Tsung-Chee,	C.E.,	Soochow, China.
Kinsey, Irwin Zipp,	B.A.,	Souderton.
Litz, Dominick,	Bus.,	San Giovanni, Italy.
Long, Robert R.,	E.M.,	Ashland.
Lund, Gosse Clarence,	B.A.,	Berlin, Conn.
MacDonald, Harry Colin,	Bus.,	Williamsport.
McKenzie, Carl Harry,	Bus.,	Dallas, Tex.
Ma, Chien. Chung,	Ch.E.,	Samarang, Java.
Mangala, Phon Jaya,	C.E.,	Debsirindra, Siam.

Miller, Harry Bachman,	Bus.,	Bethlehem.
Morgan, William John,	Bus.,	Bethlehem.
Parlour, Clarence Henry,	B.A.,	Allentown.
Rhoads, Byron Elmer, Jr.,	C.E.,	Big Stone Gap, Va.
Ricapito, Joseph,	Bus.,	Bethlehem.
Smith, Harradon H.,	Geol.,	Bethlehem.
Wong, Chii Fun,	E.M.,	Huosium, China.
Ziegenfuss, Charles Edwin,	Bus.,	Bethlehem.
Zinszer, Harvey Alfred,	B.A.,	Allentown.

STUDENTS IN EVENING COURSES IN NAVAL ARCHITECTURE

The following list includes non-matriculated students who are taking evening courses in Naval Architecture and Marine Engineering described on pages 133-134. The courses in which the students are enrolled are indicated by numbers: 1, Elements of Naval Architecture; 2, Elements of Strength of Materials; 3, Elements of Steam Power.

	COURSE	RESIDENCE
Anderson, William Coull,	2	Bethlehem.
Artis, Albert Edward,	3	Bethlehem.
Bass, Walter,	2, 3	Bethlehem.
Buchenheu, Harry,	1	Bethlehem.
Calcutt, George Frederick,	2, 3	Bethlehem.
Elderkin, Arthur Thomas,	2, 3	Bethlehem.
Gross, David Beecher,	1, 2	Bethlehem.
Gunville, Francis Daniel,	2, 3	Bethlehem.
Hackett, Thomas James,	2	Bethlehem.
Hanson, August Olaf,	2	Bethlehem.
Hebble, Chester Mackey,	2, 3	Bethlehem.
Hodge, William Ernest,	2, 3	Allentown.
Issbrucker, Carl William,	1	Bethlehem.
Jolly, William Henry,	1, 2, 3	Bethlehem.
Jones, Harold Nichols,	1, 2	Bethlehem.
Lockwood, Edward Mead,	2	Bethlehem.
Manning, Frederick William,	1	Bethlehem.
Mark, Carl Frank,	2, 3	Catasauqua.
Nelson, Daniel Reimert,	1	Bethlehem.
Ohlson, Paul Otto,	2, 3	Bethlehem.
Peterson, Thoralf Roh,	1, 2	Bethlehem.
Pinel, Roland Hammond.	1	Bethlehem.
Reitzel, James Garret,	2, 3	Bethlehem.

Rosa, Leo Chester,	2, 3	Bethlehem.
Safka, Joseph Charles,	2, 3	Bethlehem.
Semprini, Edgar,	2	Allentown.
Scott, William Jones,	3	Bethlehem.
Sheehan, Richard White,	2, 3	Bethlehem.
Storey, George Booth,	2	Bethlehem.
Thomas, Wesley Courtland,	2, 3	Easton.
Tufts, Russell Daniel,	2, 3	Bethlehem.
Werley, Richard Elias,	1	Allentown.
Yama, Arthur,	1	Bethlehem.
Youngquist, Alvin,	2, 3	Bethlehem.

STUDENTS IN EVENING SCHOOL OF BUSINESS ADMINISTRATION

The following list includes non-matriculated students who are pursuing courses in the Evening School of Business Administration, described on pages 131-132. The courses in which the students are enrolled are indicated by numbers: 1, Business Law; 2, Banking and Currency; 3, Accounting; 4, Economics.

NAME	COURSE	RESIDENCE
Bader, Harry Walker,	1, 2, 3	Bethlehem.
Baer, John G.,	1, 2, 3, 4	Allentown.
Bean, Roscoe D.,	1, 2, 3	Bethlehem.
Beyer, Carl F. W.,	1, 2, 3, 4	Bethlehem.
Brady, Frank J.,	1, 2, 3	Bethlehem.
Browd, Irwin R.,	1, 2, 3, 4	Bethlehem.
Childs, George Lawton,	3	New York, N. Y.
Childs, Raymond Austin,	3	New York, N. Y.
Cole, Franklin,	1, 2, 3, 4	Bethlehem.
Cressman, Grant J.,	1, 2, 3, 4	Bethlehem.
Dennis, Charles W.,	1, 2, 3	Bethlehem.
Ditterline, Roy E.,	1, 2, 3, 4	Bethlehem.
Doggett, Egbert B.,	1, 2, 3, 4	Bethlehem.
Eberhart, Isaac K.,	1, 2, 3, 4	Bethlehem.
Felker, William H.,	1, 2, 3, 4	Bethlehem.
Finkle, Ralph,	1, 2, 3	Allentown.
Foote, Marshall H.,	3	So. Norwalk, Conn.
Friedman, Jacob,	1, 2, 3, 4	Bethlehem.
Gasda, Stephen A.,	1, 2, 3, 4	Bethlehem.
Glace, William W.,	1, 2, 3	Bethlehem.
Groman, Harold E.,	1, 2, 3, 4	Bethlehem.

Haehnle, Edward D.,	1, 2, 3	Bethlehem.
Hartzell, Ralph,	3	York.
Herrington, A. S.,	3	Latrobe.
Hoffman, George E.,	1, 2	Bethlehem.
Hoffner, Bernard C.,	1, 2, 3	Bethlehem.
Huffman, Milton K.,	1, 2, 3, 4	Bethlehem.
Hughart, William O.,	1, 2, 3, 4	Grand Rapids, Mich.
Judd, Merritt F.,	1, 2, 3, 4	Bethlehem.
Kanuck, John A.,	1, 2, 3, 4	Bethlehem.
Keeler, Austin E.,	1, 2, 3, 4	Bethlehem.
Kilpatrick, Laurence A.,	1, 2, 3, 4	Bethlehem.
Knodler, LeRoy Francis,	3	Bethlehem.
Kunkel, Luther G. N.,	1, 2, 3, 4	Allentown.
Lyon, William H.,	1, 2, 3, 4	Bethlehem.
MacGregor, Louis J.,	1, 2, 3, 4	Allentown.
McGlade, William J.,	3	Allentown.
Machado, José A., Jr.,	1, 2, 3	Bethlehem.
Millar, Edward A., Jr.,	1, 2, 3, 4	Bethlehem.
Miller, Henry Charles,	1, 2, 3, 4	Bethlehem.
Moore, Alfred Warren,	2	Bethlehem.
Myers, Ralph S.,	1, 2, 3, 4	Bethlehem.
O'Donnell, John J.,	1, 2, 3, 4	Bethlehem.
Parrish, John Leo,	1, 2, 3	Bethlehem.
Peffer, Samuel T.,	1, 2, 3, 4	Bethlehem.
Quier, Walter Charles, Jr.,	1, 2, 3	Bethlehem.
Ramsay, John G.,	1, 2, 3, 4	Bethlehem.
Risser, Earl Thomas,	1, 2, 3, 4	Bethlehem.
Rogers, William Joyce,	1, 2, 3, 4	Bethlehem.
Rosewarne, Charles H.,	2, 4	Bethlehem.
Ruyak, George J.,	1, 2, 3, 4	Bethlehem.
Schaffer, Earl E.,	1, 2, 3, 4	Bethlehem.
Scholl, Clifford Milton,	1, 2, 3, 4	Allentown.
Smith, Samuel R.,	1, 2, 3, 4	Bethlehem.
Snyder, Martin F.,	1, 2, 3, 4	Bethlehem.
Snyder, Robert N.,	1, 2, 3	Bethlehem.
Toohey, William J.,	2	Bethlehem.
Weiser, Grant,	1, 2, 3, 4	Hellertown.
Wetterau, Charles Henry,	2	Bethlehem.
Yeager, Stanley E.,	1, 2, 3, 4	Hellertown.
Boynton, Henry G.,	3	New York, N. Y.
Zimmerman, Eugene M.,	3	Bethlehem.

STUDENTS IN EXTENSION COURSES

The following list includes non-matriculated students who are pursuing collegiate or postgraduate courses from among those listed on pages 125-130 of this Register. In addition, candidates for the Master's degree who have also enrolled in such extension classes are included in the list of extension students. The letter G after the student's name indicates that the work he is pursuing is recognized to be of graduate character.

The courses in which the students are enrolled are indicated by numbers as follows: 1, General Biology; 2, Education of the Defective and Abnormal; 3, Demonstration in the Education of the Defective; 4, Educational Measurements; 5, Occupational Therapy; 6, Project Method; 7, School Administration; 8, Public Speaking; 9, French; 10, Geology; 11, Mental Diagnosis; 12, Mental Hygiene; 13, Mental Clinic; 14, Social Psychology; 15, Spanish; 16, Educational Dramatics; 17, Logic.

SUMMER SESSION, 1920

	COURSE	RESIDENCE
Babcock, Mary,	11, 12, 13,	Bethlehem.
Barner, Richmond Bryan,	9, 11, 14,	Kutztown.
Bishop, Louise Antoinette, A.B.,	3, 5,	Bethlehem.
Diecks, Ella,	2, 5, 11, 12,	Hackensack, N. J.
Eichman, Caroline,	2, 5, 11, 12, 16	Easton.
Dimmick, Pearl Anna,	9, 16,	Hellertown.
Dwyer, Mary,	11, 12,	Bethlehem
Fink, Marjorie,	16,	Bethlehem.
Gavin, Emma C.,	11, 12,	Bethlehem
Gelpke, Mary Catherine,	11, 12, 14, 16,	Phillipsburg N. J.
Grime, Regina Christina,	9, 16,	Bethlehem.
Harmon, Neva M.,	5, 12, 13, 14,	Phillipsburg, N. J.
Hartzell, Ada K.,	2, 12, 13,	Harrisburg.
Hale, Edna Mae,	2, 3, 5, 11, 12,	Mahanoy City.
Hillard, Barbara E.,	2, 3, 5, 13,	Harrisburg.
Jacobs, Homer Miller, Ph.B.,	12, 13, 16,	Norristown.
Muth, William Edward,	15,	Pen Argyl.
Nichols, Elizabeth Melvin,	2, 11, 12, 16,	Easton.
Nolf, Laura A.,	3, 5,	Center Valley.
Patterson, Arthur C.,	9, 15, 16,	Philadelphia.

Pelzel, Helene,	2, 5, 13,	Harper.
Pohl, Elizabeth Shimer,	2, 5, 11, 12, 16,	Easton.
Ringleben, August Andrew, A.B.,	11, 12, 14,	Hazleton.
Rundle, Jessie Mae,	2, 11, 12, 16,	Easton.
Scott, Rachel M.,	2, 11, 12, 16,	Easton.
Scott, Rosa Elizabeth,	2, 11, 12, 16,	Easton.
Villee, Sallie H.,	5, 11, 12, 13,	Bethlehem.
Webber, Clella,	2, 5, 13,	Ozark, Mo.
Welch, Marion Esther,	11, 12, 13,	Bethlehem.
Whitney, Sarah May,	2, 5, 11, 13,	Fitchburg, Mass.

FIRST TERM, 1920-1921

	COURSE	RESIDENCE
Adams, Cora,	6,	Harrisburg.
Albright, Denton M., A.B.,	6, 14,	Harrisburg.
Allen, Constance,	1,	Bethlehem.
Allen, Dorothy,	1,	Bethlehem.
Allen, Elsie,	11,	Frankford.
Alleman, Catherine,	6,	Harrisburg.
Amrhein, Virginia,	1,	Bethlehem.
Anderson, Mabel,	11,	Atlantic City, N. J.
Armppriester, Helen,	6,	Harrisburg.
Arnold, Herbert Franklin, A.B.,	4, 8,	Easton.
Asper, Elda Mae,	6,	Harrisburg.
Atkinson, Mary C.,	12,	Atlantic City, N. J.
Aughenbaugh, Margaret Louise,	6,	Harrisburg.
Ayers, Mrs. Roy,	12,	Atlantic City, N. J.
Baas, Florence E.,	11, 17,	Bethlehem.
Babcock, Mary Kirk,	13,	Bethlehem.
Bachman, Charles Clinton, A.B.,	6, 14,	Allentown.
Bachman, Mary E.,	4,	Phillipsburg, N. J.
Baker, Elizabeth S.,	6,	Harrisburg.
Balsley, Catherine Marie,	6,	Harrisburg.
Banks, Helen Whitney,	6,	Harrisburg.
Barthol, Preston C.,	8,	Bethlehem.
Baskin, Caroline,	6,	Harrisburg.
Bates, Lena May,	11,	Pleasantville, N. J.
Beattie, Marjorie, A.B.,	11,	Philadelphia.
Beckwith, Florence,	4,	Phillipsburg, N. J.
Beers, Ida,	4,	Phillipsburg, N. J.

Benfield, Charles E.,	6,	Allentown.
Bentzel, Edith M.,	6,	Harrisburg.
Bentzel, Flora B.,	6,	Harrisburg.
Bergin, Emilie E.,	8,	Easton.
Bergstresser, J. L.,	8,	Bethlehem.
Bett, Helen,	6,	Hazleton.
Bieber, Agnes L.,	8,	Phillipsburg, N. J.
Bigelow, Eva,	4,	Phillipsburg, N. J.
Billow, Milton Oscar, A.B.,	6, 14,	Harrisburg.
Bishop, Louise Antoinette, A.B.,	13,	Bethlehem.
Bishop, Sarah Emily, A.B.,	6, 13,	Bethlehem.
Boyer, Orpha Curry,	4,	Phillipsburg, N. J.
Brabson, Violet L.,	8,	Easton.
Breen, Etta,	4,	Phillipsburg, N. J.
Bresee, Harriet M.,	11,	Atlantic City, N. J.
Broadbent, Earl L.,	11,	Philadelphia.
Broome, Mary,	11,	Bethlehem.
Brown, Elizabeth,	11,	Easton.
Brown, Charles Welker, C.E.,	8,	Bethlehem.
Brown, Clara Josephine,	6,	Harrisburg.
Bruce, Janet E.,	11, 17,	Bethlehem.
Brunner, William Albert, A.B.,	6, 14,	Harrisburg.
Burkholder, Mary Elizabeth,	6,	Harrisburg.
Burke, Helen,	6,	Bethlehem.
Burwell, Linnie M.,	8,	Phillipsburg.
Bush, Frank Royce,	8,	Bethlehem.
Butz, Nelson M.,	14,	Allentown.
Carl, D. M.,	8,	Bethlehem.
Campbell, E. Alva,	12,	Philadelphia.
Carroll, Clara,	1,	Bethlehem.
Carroll, John H.,	10,	Easton.
Child, Florence C., M.D., Ph.D.,	13,	Philadelphia.
Child, Dorothy, M.D., Ph.D.,	13,	Philadelphia.
Child, Nina G.,	11,	Philadelphia.
Clemens, R. A.,	11,	Atlantic City, N. J.
Clifton, Henrietta,	11, 13,	Philadelphia.
Clouser, Ann G.,	6,	Harrisburg.
Cody, Mary A.,	4,	Phillipsburg, N. J.
Coleman, R. Emma,	6,	Harrisburg.
Collins, Laura E.,	11,	Pleasantville, N. J.

Compton, Alma Gertrude,	4, 8,	Easton.
Connell, J. B.,	8,	Bethlehem.
Connolly, Mary,	8,	Phillipsburg, N. J.
Cook, Harold Earl,	8,	Phillipsburg, N. J.
Cooper, Anne Lewis, A.B.,	11,	Atlantic City, N. J.
Cooper, Carol C.,	8,	Phillipsburg, N. J.
Cortelyou, Frank D.,	4,	Washington, N. J.
Coyle, W. Radford,	8,	Bethlehem.
Crane, Mary Evelyn,	6,	Harrisburg.
Crittenden, E. Madge,	11,	Bradford, N. H.
Crobaugh, Marie L.,	1, 17,	Easton.
Cross, Thomas J.,	12,	Atlantic City, N. J.
Crowl, Anna Virginia,	6,	Harrisburg.
Dailey, Hattie,	4,	Phillipsburg, N. J.
Danner, Muriel,	1,	Bethlehem.
Davis, Annie,	4,	Phillipsburg, N. J.
DeYoung, Mrs. Rosa Stein,	11,	Overbrook.
Ditton, Anna Louise,	4,	Phillipsburg, N. J.
Dick, Dorothy K.,	8,	Phillipsburg, N. J.
Ditton, Mary,	4,	Phillipsburg, N. J.
Dodson, Alan Craig, B.S.,	8,	Bethlehem.
Dodson, Truman Monroe, B.S.,	8,	Bethlehem.
Dreifoos, Hattie,	6,	Allentown.
Dreisbach, Matilda V.,	8,	Phillipsburg, N. J.
Dressor, Chauncey E., D.D.S.,	8,	Bethlehem.
Dugan, Cora E.,	6,	Harrisburg.
Durnin, Cecelia,	6,	Allentown.
Dwyer, Mary M.,	6, 13,	Bethlehem.
Early, Stella Stewart,	6,	Harrisburg.
Ehrgott, W. F.,	8,	Bethlehem.
Eliason, Mary Ethel,	11,	Holidaysburg.
Elliott, Mrs. Mary Fiske,	4,	Phillipsburg, N. J.
Ewart, Carrie B.,	11,	Longport, N. J.
Fairlamb, Mary Eleanor,	11, 12,	Philadelphia.
Faust, Paul Bertrand, B.S.,	6, 14,	Harrisburg.
Fautchey, Laura,	6,	Harrisburg.
Fegeley, Solon J., A.B.,	14,	Allentown.
Fenton, Hattie,	11,	Atlantic City, N. J.
Ferguson, Bertha S.,	6,	Harrisburg.
Ferguson, J. Frazier,	6,	Harrisburg.

Fetherolf, Martin D., B.A.,	14,	Allentown.
Findlay, Laura H.	6,	Allentown.
Findley, Helen G.,	13,	Philadelphia.
Finton, Marie J.,	6,	Harrisburg.
Fisher, Clara May,	6,	Harrisburg.
Fitzimons, Lillian,	6,	Harrisburg.
Fitzpatrick, Florence,	11,	Philadelphia.
Flynn, Mary A.,	8,	Philadelphia.
Foley, Jessie Romig,	6,	Allentown.
Frame, Christine D.,	8,	Phillipsburg, N. J.
Frank, Celia,	12,	Philadelphia.
Frederick, Laura A.,	11,	Easton.
Frey, Clifford Foster,	8,	Bethlehem.
Friedlander, Sarah, A.B.,	14,	Allentown.
Fritsch, J. Warren,	14,	Allentown.
Fulmer, Kathryn Rose,	11,	Easton.
Fulper, Blanche Titus,	8,	Phillipsburg, N. J.
Fulper, Emma Walton,	4,	Stewartsville.
Funk, M. Estella,	11,	Philadelphia.
Gamble, Maude J.,	6,	Harrisburg.
Gannon, Elizabeth G.,	11,	Atlantic City, N. J.
Gayman, Paul S.,	10,	Easton.
Gebhard, M. Arline,	11, 17,	Bethlehem.
Geidner, Dorothy M.,	6,	Allentown.
Gelpke, Mary Catherine,	13,	Phillipsburg, N. J.
Gifford, John Warren,	11,	Pleasantville, N. J.
Gilchrist, Jessie L., A.B.,	11,	Atlantic City, N. J.
Gilroy, Ada E.,	8,	Phillipsburg, N. J.
Glasier, J. Arthur, B.D.,	11, 17,	Bethlehem.
Goldsmith, Elizabeth S.,	6,	Harrisburg.
Goetz, George Herman,	6,	Harrisburg.
Good, Grace,	11,	Pleasantville, N. J.
Goodman, Howard E.,	8,	Bethlehem.
Gordown, Agnes B.,	8,	Phillipsburg, N. J.
Gray, Viola M.,	13,	Philadelphia.
Grove, LaVene,	6,	Harrisburg.
Grubb, Percy Lamar, B.A.,	6, 14,	Harrisburg.
Guyer, J. Pierce,	8,	Bethlehem.
Hager, Anna Loise,	4,	Phillipsburg, N. J.
Haifleigh, Catherine,	6,	Harrisburg.

Hake, Mrs. Edith Thomas,	6,	Harrisburg.
Hall, Mabel Santavieve,	6,	Harrisburg.
Hamaker, Gertrude E.,	6,	Harrisburg.
Hammell, Ethel C.,	12,	Atlantic City, N. J.
Hanlon, Mary Dorothy,	6,	Allentown.
Hardy, Helen Elizabeth,	8,	Easton.
Harmon, Neva M.,	8, 13,	Phillipsburg, N. J.
Harris, Anna Pauline,	6,	Harrisburg.
Harris, Eulalia A.,	8,	Phillipsburg, N. J.
Harris, Minnie C.,	8,	Phillipsburg, N. J.
Hartman, Fred B.,	8,	Bethlehem.
Hassler, Mrs. Helen A.,	6,	Harrisburg.
Heiges, Walter C.,	6,	Harrisburg.
Helfrich, Emory W.,	11,	Pleasantville, N. J.
Henschen, George N. C., A.B.,	6, 14,	Harrisburg.
Henry, Margaret Lee,	12,	Atlantic City, N. J.
Hepford, Minerva S.,	6,	Harrisburg.
Hoagland, Ada May,	11, 12,	Atlantic City, N. J.
Hocker, Peter L.,	6,	Harrisburg.
Hoere, Herman W.,	8,	Bethlehem.
Hofford, Hilda Naomi,	1, 10, 11,	Allentown.
Hoffsommer, Mabel Olive,	6,	Harrisburg.
Hook, Clara H.,	6,	Harrisburg.
Housekeeper, M. A.,	11,	Philadelphia.
Hoover, Ruth M.,	6,	Harrisburg.
Houser, Lillian M.,	4, 6,	Phillipsburg, N. J.
Howard, Joseph A., B.Sc.,	11,	Pleasantville, N. J.
Huber, Gertrude,	6,	Harrisburg.
Huber, Katherine Fern,	6,	Harrisburg.
Huber, Marion Christ,	1, 11,	Bethlehem.
Huhn, Anna Miriam,	8,	Easton.
Huhn, Blanche Alice,	8,	Easton.
Hulsizer, Margaret Alice,	8,	Easton.
Hummer, Miles C.,	6,	Harrisburg.
Ingersoll, Charles Wesley, M.S.,	11,	Pleasantville, N. J.
Jacoby, Clinton B.,	8,	Bethlehem.
Kahler, Bertha M.,	8,	Phillipsburg, N. J.
Kane, George,	8,	Phillipsburg, N. J.
Karsch, Karl H.,	6, 7, 14,	Allentown.
Kast, Bessie Edna, B.A.,	6, 14,	Harrisburg.

Keiper, Edward Detweiler,	6,	Harrisburg.
Keiter, Annie R.,	6,	Harrisburg.
Kennedy, Mary M.,	6,	Harrisburg.
Kenney, Caleb Samuel, C.E.,	10,	Bethlehem.
Kern, Nelson Eugene,	14,	Allentown.
Kessler, Harvey W.,	8,	Bethlehem.
Kessler, Rosa M.,	14,	Allentown.
King, Corinne,	11,	Pleasantville, N. J.
King, Franklin G.,	8,	Bethlehem.
Kistler, Alfarata P.,	6,	Allentown.
Kittredge, Harold Woodworth,	11,	Atlantic City, N. J.
Klavans, Leah Florence,	6,	Harrisburg.
Kleckner, Ruth Emma,	10,	Bethlehem.
Knox, Elizabeth Stewart,	6,	Harrisburg.
Koons, Caroline Elizabeth,	6,	Allentown.
Koser, Josephine R.,	6,	Harrisburg.
Kob, John F.,	6,	Harrisburg.
Krall, Helen,	6,	Harrisburg.
Kreider, Minerva M.,	6,	Harrisburg.
Kressler, Ray H.,	6, 14,	Allentown.
Kressler, Helen Roseberry,	6,	Finesville, N. J.
Lake, Mrs. Flora G.,	4, 8,	Phillipsburg, N. J.
Landis, Adele M.,	1,	Coopersburg.
Lamberton, Mary,	4,	Easton.
Laubach, Pauline Elizabeth,	1,	Easton.
Lawton, Grace Evelyn,	12,	Philadelphia.
Leaman, Ruth,	6,	Allentown.
Leeds, Abbie M.,	11,	Somers Point, N. J.
Leeds, Nettie C.,	11,	Somers Point, N. J.
Leiby, Mary Esther,	6,	Allentown.
Lentz, Hazel Irene,	6,	Harrisburg.
Lerch, Raymond,	4,	Phillipsburg, N. J.
Leshner, Mrs. Edith,	4,	Phillipsburg, N. J.
Leswing, Joseph, M.A.,	14,	Harrisburg.
Lewis, Mary C.,	12,	Philadelphia.
Lewis, Mrs. W. P.,	8,	Phillipsburg, N. J.
Lindsay, Moses Alexander, M.A.,	6,	Harrisburg.
Loosbach, Elizabeth,	10,	Allentown.
Lopp, Mildred,	10,	Bethlehem.
Lott, Margaret Geraldine,	4,	Phillipsburg, N. J.

Lucas, Marjorie,	12,	Philadelphia.
Luckenbach, Martha,	1,	Bethlehem.
Luria, Pauline L.,	11, 12, 13,	Philadelphia.
Lynch, Mary Adelaide,	4,	Phillipsburg, N. J.
MacAlister, Nan,	11,	Philadelphia.
McCarthy, Margaret Theresa,	4,	Phillipsburg, N. J.
McCaulley, Selinda,	11, 13,	Philadelphia.
McCormick, Mildred H.,	6,	Harrisburg.
McClary, Grace Lucy,	4,	Phillipsburg, N. J.
McCullough, Harry A., B.S.,	6, 14,	Allentown.
McGowan, Alice C.,	6,	Harrisburg.
McHale, Anna Colette,	4,	Phillipsburg, N. J.
McHenry, Sara M.,	12,	Philadelphia.
McNally, John H.,	8,	Bethlehem.
McLaughlin, Catherine Tyne,	4,	Phillipsburg, N. J.
Mack, Henry J.,	8,	Bethlehem.
Maloney, Michael Edward,	4,	Phillipsburg, N. J.
Mann, Mrs. Edna F.,	6,	Harrisburg.
Markle, Ella Evelyn,	4,	Easton.
Marstellar, Howard T.,	11,	Somers Point, N. J.
Maurer, Mabel,	6,	Harrisburg.
Maury, Emma Elizabeth,	6,	Allentown.
Meckley, Mabel Lorene,	6,	Harrisburg.
Melville, Claudine,	6,	Harrisburg.
Mengel, Priscilla D.,	11,	Philadelphia.
Mengel, C. E.,	8,	Bethlehem.
Metzger, Elizabeth,	10,	Bethlehem.
Metz, Florence Estella,	4,	Pittsburgh.
Meyers, Samuel,	8,	Bethlehem.
Mickey, Mary,	6,	Harrisburg.
Midlam, Anna M.,	6,	Harrisburg.
Mill, Ella,	8,	Easton.
Miller, Elmer F.,	14,	Orefield.
Miller, Gertrude R.,	6,	Harrisburg.
Miller, Lillie M.,	6,	Harrisburg.
Minnig, Blanche LaVergne,	6,	Harrisburg.
Minton, Louise,	4,	Washington, N. J.
Mitchell, Helen C.,	8,	Phillipsburg, N. J.
Mitchell, Minnie C.,	8,	Phillipsburg, N. J.
Mood, Edwin Nunamaker,	4,	Phillipsburg, N. J.

Moos, Stella Wolf,	11,	Jenkintown.
Moyer, Anna C.,	8,	Phillipsburg, N. J.
Mueller, Margaret,	10,	Watertown, Wis.
Munroe, Henry C., M.D.,	11,	Pleasantville, N. J.
Murray, Marion H.,	6, 11,	Bethlehem.
Myers, Margaret,	6,	Harrisburg.
Myers, Carrie Estella,	6,	Harrisburg.
Myers, Elizabeth Adeline,	4,	Phillipsburg, N. J.
Nice, Ruth A.,	10,	Upper Black Eddy.
Nicholas, Elizabeth M.,	13,	Easton.
Nie, Alice Esther,	4,	Phillipsburg, N. J.
Nixon, Elsie M.,	6,	Harrisburg.
Nixon, Helen B.,	6, 14,	Harrisburg.
Nixon, W. Sargent,	8,	Phillipsburg, N. J.
O'Connell, Mary,	6,	Harrisburg.
Olanoff, Rose,	11,	Philadelphia.
Ort, Florence,	6,	Harrisburg.
Orth, Carrie, Louise,	6,	Harrisburg.
Orth, Rebecca,	6,	Harrisburg.
Paist, Anna Windle,	11, 12,	Philadelphia.
Parrish, Charlotte B.,	8,	Phillipsburg, N. J.
Patterson, Caroline,	6,	Harrisburg.
Pearson, Elizabeth A.,	8,	Easton.
Pedley, Florella F., A.B.,	11,	Philadelphia.
Pendergast, Gertrude Elizabeth,	6,	Harrisburg.
Pfeiffer, Marie Elizabeth.	4,	Phillipsburg, N. J.
Pierson, Nattie E.,	4,	Phillipsburg, N. J.
Pohl, Elizabeth Shimer,	8, 13,	Easton.
Pursell, Mrs. Ada Sliker,	4,	Phillipsburg, N. J.
Quinn, Lucy,	12,	Atlantic City, N. J.
Radford, G. Reginald,	8,	Bethlehem.
Rausch, Katherine Alice,	6,	Allentown.
Rausch, Caroline Thomas,	6,	Progress.
Ray, James R.,	8,	Bethlehem.
Reeder, Howard D.,	8,	Bethlehem.
Reen, Sarah Kerner,	6,	Harrisburg.
Renninger, John Daub, A.B.,	6, 14,	Harrisburg.
Reaser, Mrs. Sarah Ella Madden,	4,	Phillipsburg, N. J.
Richards, W. F.,	11,	Pleasantville, N. J.
Richwine, George H.,	6,	Harrisburg.

Reilley, Josephine C.,	8,	Phillipsburg, N. J.
Rhoades, Eleanor,	11,	Philadelphia.
Rishel, Dorothy M.,	6,	Harrisburg.
Roarty, Margaret Anne,	6,	Allentown.
Robeson, Vida A.	4,	Phillipsburg, N. J.
Robinson, Edward Moore, E.M.,	8,	Bethlehem.
Romig, Helen Elizabeth,	1,	Philadelphia.
Rose, Edward Gardner,	6,	New Cumberland.
Ross, Florine,	11,	Camden, N. J.
Roth, Lillie Hannah,	6,	Allentown.
Ruch, Asker J.,	8,	Bethlehem.
Ruef, Rorothy Northrup,	4,	Phillipsburg, N. J.
Rundle, Jessie M.,	13,	Easton.
Sanford, A.,	4,	Washington, N. J.
Schaeffer, Anna,	4,	Phillipsburg, N. J.
Schaible, Cora,	11,	Absecon, N. J.
Scheirer, Esther M.,	6,	Allentown.
Schick, Floyd E.,	8,	Bethlehem.
Schlaepfer, Robert G.,	8,	Bethlehem.
Schlayer, Anna C.,	6,	Harrisburg,
Schott, Frank W.,	8,	Bethlehem.
Schwaninger, Mary Alice, A.B.,	18,	Allentown.
Scott, Rachel M.,	13,	Easton.
Scott, Rosa Elizabeth,	13,	Easton.
Search, Hendrick Monroe, C.E.,	8,	Bethlehem.
Seiberling, Anna C.,	11,	Atlantic City, N. J.
Shane, Mary E.,	6,	Harrisburg.
Sherk, Esther,	6,	Harrisburg.
Shilling, Margaret E.,	6,	Harrisburg.
Shimer, Robert Hoffman, M.E.,	8,	Bethlehem.
Shoemaker, Rebecca Jane,	6,	Harrisburg.
Short, Ida K.,	6,	Harrisburg.
Showell, Townsend D.,	11,	Philadelphia.
Shradley, Mildred,	6,	Harrisburg.
Shunk, Helen,	1,	Bethlehem.
Simons, Helen Britten,	11,	Philadelphia.
Slosson, Mrs. Helen M.,	4, 8, 11, 17,	Easton.
Smith, Hilda R.,	11,	Petersburgh, N. J.
Smith, Martha S.,	8,	Easton.
Snyder, Vera,	8,	Easton.

Somers, Mary C.,	11,	Atlantic City, N. J.
Sotzing, Ralph W.,	8,	Bethlehem.
Sourbeer, Dora Calder,	6,	Harrisburg.
Spangler, Nora M.,	6,	Harrisburg.
Spatz, Eva Margaret,	6,	Allentown.
Starr, C. T.,	8,	Bethlehem.
Stambaugh, Elda G.,	6,	Harrisburg.
Steelman, Henrietta,	11,	Pleasantville, N. J.
Stemler, Hettyer Esther,	6,	Harrisburg.
Stephenson, Ida M.,	11,	Pleasantville, N. J.
Stover, Bertha L.,	11,	Philadelphia.
Strohmeier, Adella E.,	6,	Easton.
Stryker, Nellie Esther,	4,	Phillipsburg, N. J.
Strauss, Jesse C.,	8,	Allentown.
Sullivan, W. C.,	11,	Pleasantville, N. J.
Tack, Sara A.,	6,	Harrisburg.
Tatnal, Edna Grace,	6, 14,	Harrisburg.
Telfer, Vera May,	4,	Belvidere, N. J.
Templeton, Kenneth Rodie,	8,	Easton.
Thierolf, Walter Raymond,	4,	Easton.
Thomas, George E.,	14,	Allentown.
Thomas, Maria C.,	11,	Pleasantville, N. J.
Thomas, Martin H.,	6,	Harrisburg.
Thomas, Mary Book,	6,	Harrisburg.
Thomas, Ralph,	4,	Phillipsburg, N. J.
Tinker, William M., M.A.,	14,	Allentown.
Tittle, A. May,	6,	Harrisburg.
Tittle, Elizabeth,	6,	Harrisburg.
Tressler, Samuel Martin,	4,	Washington, N. J.
Trimmer, John William,	4,	Phillipsburg, N. J.
Tritt, Elizabeth,	6,	Harrisburg.
Turner, Mary Eleanor,	6,	Bethlehem.
Updegraff, Sadie,	11,	Atlantic City, N. J.
Valentine, Mary B.,	11,	Westville, N. J.
Van Gilder, Sara S.,	11,	Petersburgh, N. J.
Vance, J. Gertrude,	11,	Atlantic City, N. J.
Vaughn, Mabel E.,	6,	Harrisburg.
Vernet, Natalie,	8,	Easton.
Viana, Mary M.,	11,	Atlantic City, N. J.
Villee, Sallie H.,	13,	Bethlehem.

Volkhardt, Charles Edward,	8,	Bethlehem.
Vollmer, Emma,	6,	Harrisburg.
Wall, Martha E.,	6,	Harrisburg.
Wallick, Mrs. Louella Christine,	6,	Bethlehem.
Wallick, Ray G.,	6, 7,	Bethlehem.
Walker, Elizabeth Ruth.	4,	Phillipsburg, N. J.
Wals, Bridgie,	4,	Phillipsburg, N. J.
Walsh, Cecelia,	4,	Phillipsburg, N. J.
Walter, Helen,	1,	Bethlehem.
Walter, Leonia Madeline,	4,	Phillipsburg, N. J.
Walters, Edith Matilda,	4,	Phillipsburg, N. J.
Walzer, Anna M.,	6,	Harrisburg.
Walzer, Ruth M.,	6,	Harrisburg.
Wantzel, Dorothy Louise,	1,	Egg Harbor City, N. J.
Warlow, Mary,	6,	Harrisburg.
Weber, Dorothy Hill,	10,	York.
Weeks, Elsie,	11,	Atlantic City, N. J.
Weirbach, T. Mahlon, B.S.,	6, 14,	Allentown.
Weirick, Iva C.,	6,	Harrisburg.
Wellman, Henry G., M.A.,	11,	Atlantic City, N. J.
Welte, Jane M.,	11,	Philadelphia.
Wentz, Homer Henry,	14,	Allentown.
Wetherhold, Ralph V.,	6,	Allentown.
Wetherstine, Katherine M.,	11,	Philadelphia.
White, Mrs. Amanda S.,	12,	Philadelphia.
Whittaker, Alice E.,	11,	Margate City, N. J.
Wilbur, Robert Eldredge,	8,	Bethlehem.
Wiley, Mary Francis,	11,	Atlantic City, N. J.
Williams, Charlotte Elizabeth,	8,	Phillipsburg, N. J.
Williams, Chester Hoagland,	4,	Phillipsburg, N. J.
Williams, Helen G.,	11,	Atlantic City, N. J.
Williams, James Henry,	6,	Harrisburg.
Williamson, Charles H.,	4,	Phillipsburg, N. J.
Wilson, Charles Oscar,	11,	Pleasantville, N. J.
Wood, Sarah Elizabeth,	6,	Harrisburg.
Woodward, Harriet N.,	8,	Phillipsburg, N. J.
Wright, Mrs. Ada V.,	6,	Allentown.
Wuchter, Miriam H.,	1,	Allentown.

Wuchter, Miriam Henrietta,	1,	Allentown.
Wyckoff, Herbert J., A.B.,	11,	Bryn Mawr.
Yeager, Howard James,	6, 7,	Emaus.
Yetter, Mary F. A.,	8,	Phillipsburg, N. J.
Ziegenfuss, Warren A.,	6, 14,	Allentown.
Zimmerman, Annie Minerva,	6,	Harrisburg.
Zimmerman, Edward W.,	6,	Allentown.

SUMMARY OF STUDENTS BY CLASSES AND COURSES

	* GRADUATES	SENIORS	JUNIORS	SOPHOMORES	FRESHMEN	SPECIALS	TOTALS
Arts & Science	36	12	5	33	48	5	139
Business.....	1	9	16	53	79	8	166
Civil Eng.....	2	24	26	44	35	3	134
Mech. Eng.....		24	25	42	67		158
Mining Eng....	3	17	21	25	30	2	98
Metal. Eng.....	12	7	17	15	24		75
Electromet.....		9					9
Electric. Eng...	6	12	14	53	47		132
Chemistry.....	8	1			2	1	12
Chem. Eng.....	2	27	39	32	47	2	149
Naval Eng.....			12	5	14	1	32
Totals	70	142	175	302	393	22	1104

*Graduate students are listed in the department in which they are taking their major subject.

Students in Evening Courses in Naval Architecture..... 34
 Students in Evening School of Business Administration.. 62
 Students in Extension Summer Session, 1920..... 30
 Students in Extension Courses, First Term, 1920-21..... 432

Total 558

GEOGRAPHICAL SUMMARY OF STUDENTS

Alabama	1
California	3
Colorado	1
Connecticut	18
Delaware	5
District of Columbia.....	45
Florida	3
Georgia	2
Illinois	6
Indiana	2
Iowa	1
Kentucky	1
Maryland	40
Massachusetts	15
Michigan	5
Minnesota	1
Missouri	1
New Hampshire	1
New Jersey	158
New York	85
North Carolina	5
Ohio	19
Oklahoma	1
Pennsylvania	612
Rhode Island	5
South Carolina	2
Tennessee	3
Texas	2
Utah	1
Vermont	1
Virginia	9
West Virginia	9
Wisconsin	3
Argentine Republic	2
Brazil	1
Chile	2
China	15

Colombia	3
Cuba	1
England	1
Greece	2
Hawaii	1
Italy	1
Japan	1
Java	1
Mexico	2
Panama	1
Russia	1
Siam	1
Spain	1
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